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PRODUCIBILITY ENGINEERING AND PLANNING (PEP) OF THE XM74 GEMSS --ETC(U)
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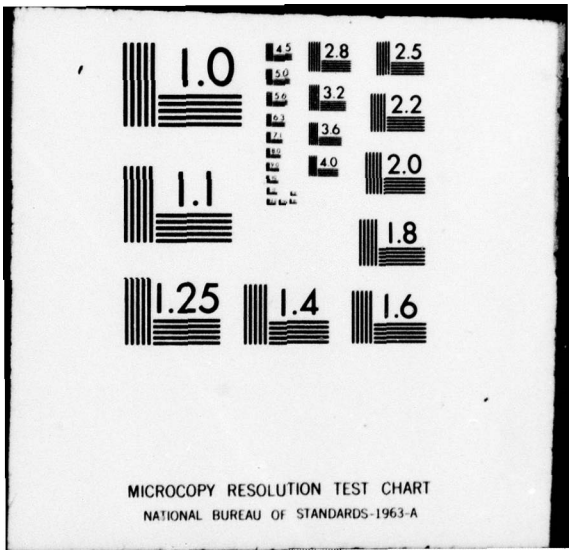
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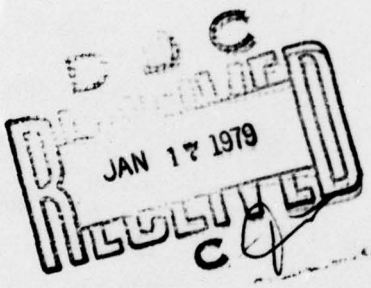
PRODUCIBILITY ENGINEERING AND PLANNING (PEP)

OF THE

XM74 GEMSS EXTENDED TRIPLINE SENSOR



30 August 1978

Final Technical Report

For Period

May 1977 to August 1978

Prepared For:

United States Army
Armament Research and Development Command
Dover, New Jersey 07801

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20. ABSTRACT (CONTINUE ON REVERSE SIDE IF NECESSARY AND IDENTIFY BY BLOCK NUMBER)

This report is a final report summarizing accomplishments for a producibility engineering and planning study of the XM74 GEMSS Extended Range Tripline Sensor. The overall purpose of the effort was to support Army mine programs by maximizing the producibility of the Extended Tripline Sensor and by a parallel effort to evolve an automated assembly machine line and associated processes for high volume, low cost production. The report is organized to provide separate sections for the two primary activities involved:

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(Cont) → The section devoted to sensor production engineering presents material on the initial design and describes proposed design changes. A second major section deals with 1. Extended Range Tripline Sensor production engineering, and 2. Machine line and test equipment design.

Also included is support effort such as Reliability, Availability, Maintainability, Safety and Human Factors Engineering.
The section devoted to sensor Production Engineering presents material on the initial design and proceeds to describe proposed design changes.
Cost data is also presented to cover the initial design and the final design resulting from the approved changes.
A final section presents recommendations for continuing activities related to the XM74 GEMSS Extended Tripline Sensor.

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I. INTRODUCTION

A. PURPOSE AND SCOPE

This final technical report is being submitted in fulfillment of the requirements of Contract DAAK10-77-C-0047, DD Form 1423 Data Item A004. The report covers Honeywell activities pursuant to this contract, which called for a Producibility Engineering and Planning (PEP) effort on the XM74 GEMSS Extended Tripline Sensor. The overall purpose of the effort was to support Army mine programs by maximizing the producibility of the Extended Tripline Sensor and by evolving in parallel an automated assembly machine production line and associated processes for high volume, low cost production. The work was conducted for ARRADCOM, and technical management was provided by Joe Rehkamp of the Large Caliber Weapons System Laboratory.

B. REPORT ORGANIZATION

This report is organized to provide separate sections for the two primary activities involved (Extended Tripline Sensor Production Engineering and Machine Line and Test Equipment Design) as well as supporting effort; i.e., reliability, availability, maintainability, safety, etc. The section on sensor Production Engineering is organized to present the initial design first and then to describe the design changes proposed in the program. This enables a clear perception of what changes were evolved and how they affected the baseline design. Cost data are contained in a separate section and cover the initial design cost and the cost as the result of approved changes. The last section of this report contains recommendations for on-going activities related to the XM74 GEMSS Extended Tripline Sensor.

C. CONTRACTUAL MATTERS

The original contract (DAAK10-77-C-0047) covered a two Phase effort running from 11 May 1977 to 30 November 1977. Contract history is as follows:

Letter Contract	11 May 1977	$98,679
Mod P00001	6 June 1977	Definitized contract
Mod P00002	27 September 1977	Extension for end of contract to 30 December 1977.
Mod P00003	9 February 1978	Supplement to scope of work added $131,248 and extended end of contract to 28 February 1978.
Mod P00004	20 July 1978	Extended end of contract to 30 August 1978.

II. SUMMARY

The program was initiated on 19 May 1977 with the intent to maximize the producibility (minimize the production cost) of the Extended Tripline Sensor and to evolve an automated assembly machine production line. The effort was conducted in two phases. Phase I activities concentrated on Tripline Sensor producibility, the design baseline for automated assembly, and the initial cost estimate. In Phase II, the emphasis was on finalization of the automated assembly machine production line and preparation of supporting technical data, including process descriptions, Quality inputs, RAM, Safety, and Human Factors Engineering.

A. PRODUCTION ENGINEERING EFFORT, XM74 GEMSS EXTENDED TRIPLINE SENSOR

In the GEMSS Extended Tripline Production Engineering effort, change proposals involving ten (10) drawings were prepared and submitted of which nine (9) were approved (see Table 1). Changes were made to the Tripline Sensor baseline design only in those cases where Project Office approval of the change proposal was received.

The approved changes increased the automated producibility of the GEMSS Sensor. Changes which increased producibility and/or directly reduced costs included the incorporation of features and configuration revisions to permit automatic handling such as the hole in the case and sleeve.

The proposed changes to the bobbin are needed to permit automatic winding in conjunction with the assembly of the weight to the bobbin.

For each proposed change, an evaluation was made to confirm the predicted benefits and to ensure no adverse effect on performance, reliability and/or safety.

The final configuration reflects a tripline sensor fully capable of automatic assembly which was not true for the baseline design.

On the basis of substantial improvements in producibility, it is concluded that Production Engineering Objective #1 for the XM74 GEMSS Extended Range Tripline Sensor was achieved during the program.

Objective #2 requires the following information pertinent to Extended Tripline Sensor production which is common (identical to the ADAM mine tripline sensor assembly facility):

TABLE 1. CHANGE PROPOSALS

Drawing Change	Description	Date Submitted	Response
0. Original	Baseline Design	10/27/77	N/A
1. 9292972	Sensor Assembly Show Piece Part Revision	8/15/77	Approved
2. 9298578	Spring Ejection	8/15/77	Rejected
3. 9292976	Sensor Case and Bobbin Assembly Pictorial Changes	8/15/77	Approved
4. 9292981	Eyelet, Interface Revise to Washer Configuration	8/15/77	Approved
5. 9292982 9292983	Bobbin Assembly Weight, Bobbin	8/15/77	Approved
6. 9292985	Bobbin Add 30° Taper, Relocate .03 Slot	8/15/77 7/31/78	Approved Open
7. 9292986	Release Mech and Case Assembly Pictorial Changes	8/15/77	Approved
8. 9292987	Case, Sensor Add (2) Sets of (4) Holes Add (4) Flutes	8/15/77	Approved
9. 9292988	Sleeve Add (2) Sets of (4) Holes	8/15/77	Approved
10. 9292989	Washer, Case Enlarge Chamber	8/15/77	Approved

- Production tooling and fixturing
- Assembly and inspection facility designs
- Manufacturing and assembly process descriptions
- Software
- Provide drawings, specifications and technical data as needed to replicate common facility items.

This information was submitted as the Common Design Study, dated 1 November 1977, and includes the following common automatic assembly machines:

Machine No. 8	Diaphragm Assembly
Machine No. 9	Housing Assembly
Machine No. 10	Release Mechanism Assembly
Machine No. 10A	Terminal Assembly

Objective #3 requires the following information pertinent to Extended Tripline Sensor production which is similar to the ADAM mine tripline sensor assembly facility and which may be modified for Extended Tripline Sensor production:

- Production tooling and fixturing
- Manufacturing and assembly process descriptions
- Software
- Design modifications and technical data to implement fabrication of modified facilities.

This information was submitted 12 June 1978 and includes the following automatic assembly machines which are similar to the ADAM machines:

Machine No. 11	Release Mechanism and Case
Machine No. 12	Sensor Case and Bobbin Assembly
Machine No. 13	Sensor and Breakwire Assembly
Machine No. 13A	Epoxy Dispenser

Objective #4 requires the following information pertinent to Extended Tripline Sensor production which is unique to the Extended Tripline Sensor assembly facility:

- Production tooling and fixturing
- Manufacturing and assembly process descriptions
- Software
- Designs and technical data as required to construct these unique facilities.

This information was submitted 12 June 1978 and includes the following automatic assembly machines which are new and unique to the Extended Tripline Sensor:

Machine No. 7	Bobbin Assembly
Machine No. 12B	Sensor Case and Spring Assembly

Objective #5 requires a cost estimate for final development, fabrication and installation of the complete production facility. This information is presented in Section VII of this report.

B. MACHINE LINE DESIGN

The design of the machine line was predicated on providing a new, highly automated production configuration to achieve the volume output capability required (200,000 units per month on a one shift, 8-hour day, 5-day week (1-8-5) shift basis and using a 50 minute hour and 21 days per month) at the lowest unit product cost. The PEP effort involved a new sensor; however, there were applicable design resources by way of machine designs from the ADAM sensor line which proved to benefit the GEMSS Sensor program. These resources were used to the maximum extent possible to facilitate the machine line design for the Extended Tripline Sensor. (Ref: Figure 1. Assembly Flow Chart.)

The basic equipment required for the machine line was determined by means of relating the Extended Tripline Sensor to the ADAM sensor. Consideration given to commonality and similarity between the two sensors made it possible to take advantage of existing ADAM machines and equipment for application to the extended range sensor. The resulting three categroies; common, similar and new, have been described above. Preliminary design work and breadboard models resulted in one entirely new machine, No. 12B. This was necessary in order to avoid unacceptable complexity in machine No. 12. One of the ADAM machines has no equivalent in the GEMSS Sensor line. This is machine No. 7A, for Bobbin taping. The extended range sensor does not use tape at this point, since the Bobbin Weight retains the tripline in the Bobbin. The two assembly lines then have the same number of machine types, namely ten (10). This we believe to be a notable accomplishment since the extended range sensor has four (4) additional piece parts compared to the ADAM sensor.

One other factor in determining a machine line to meet the capability requirement involved the Bobbin Winder. Since the Extended Tripline uses more than twice the amount of line compared to the ADAM sensor, the quantity of Bobbin Winding machines required is doubled. Honeywell has developed a new high speed winding station on this contract which reduces the quantity of Bobbin winders required. Initially, it was determined that five (5) of these

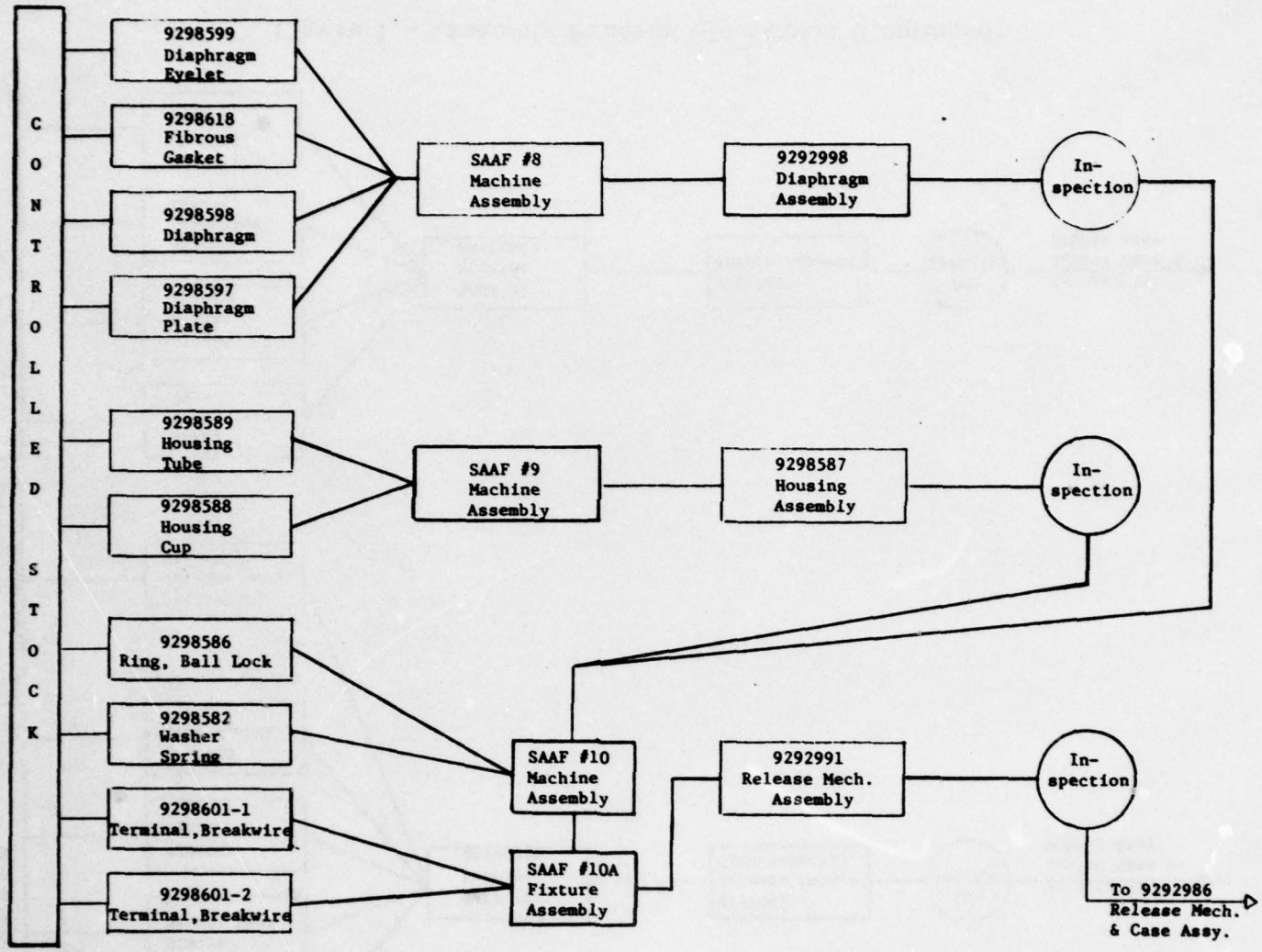

Figure 1. Assembly Process Flow Chart

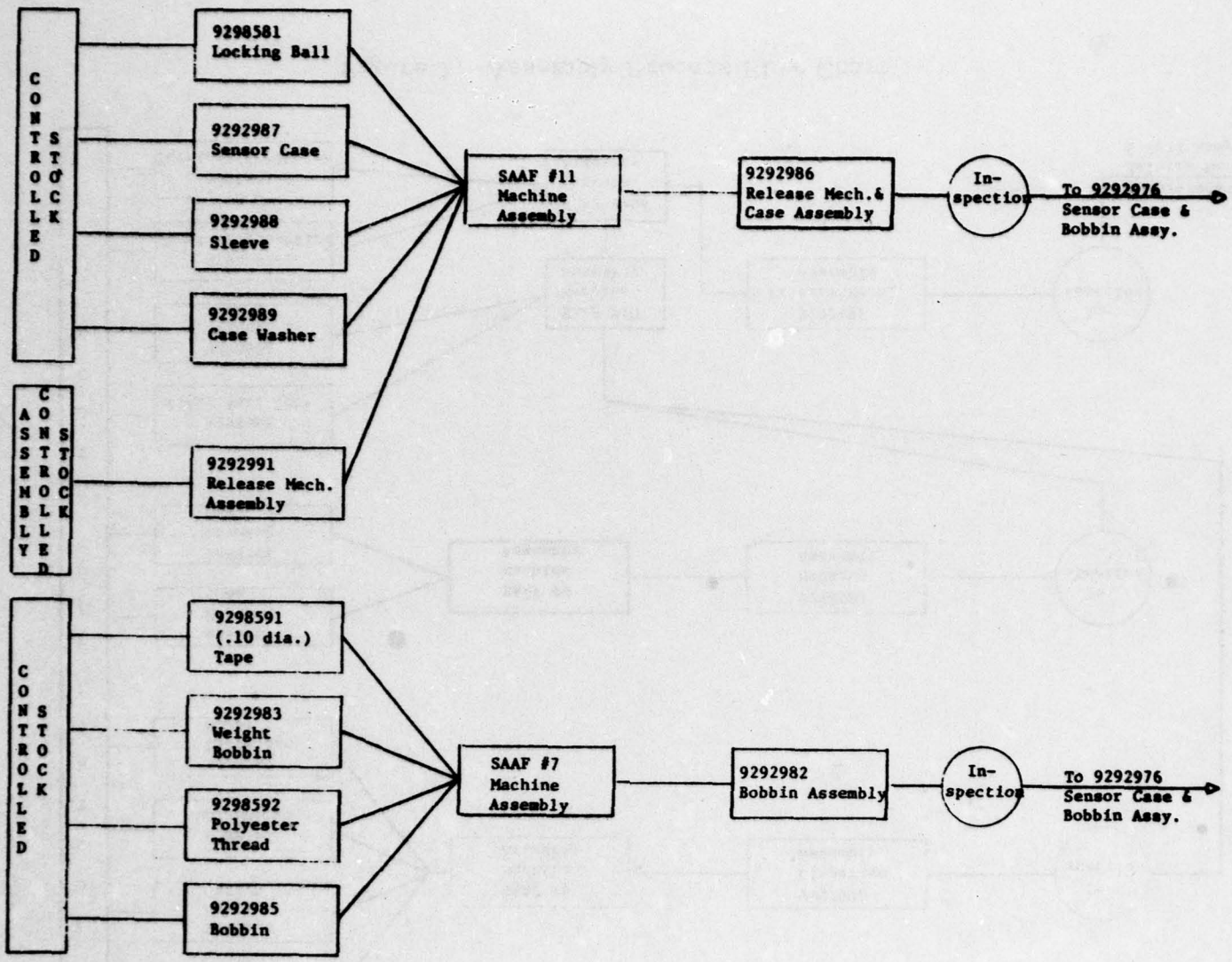

Figure 1. Assembly Process Flow Chart (Continued)

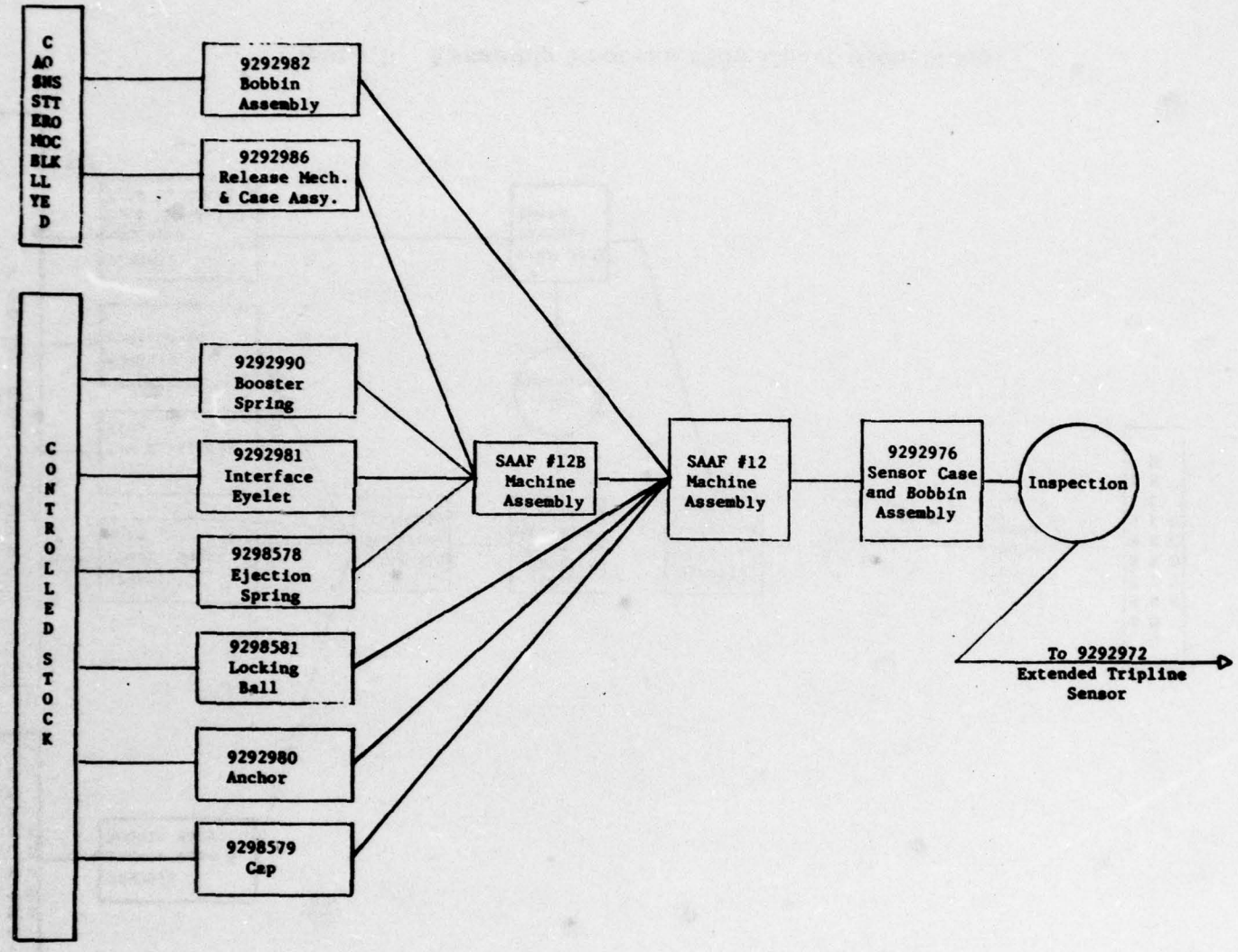

Figure 1. Assembly Process Flow Chart (Continued)

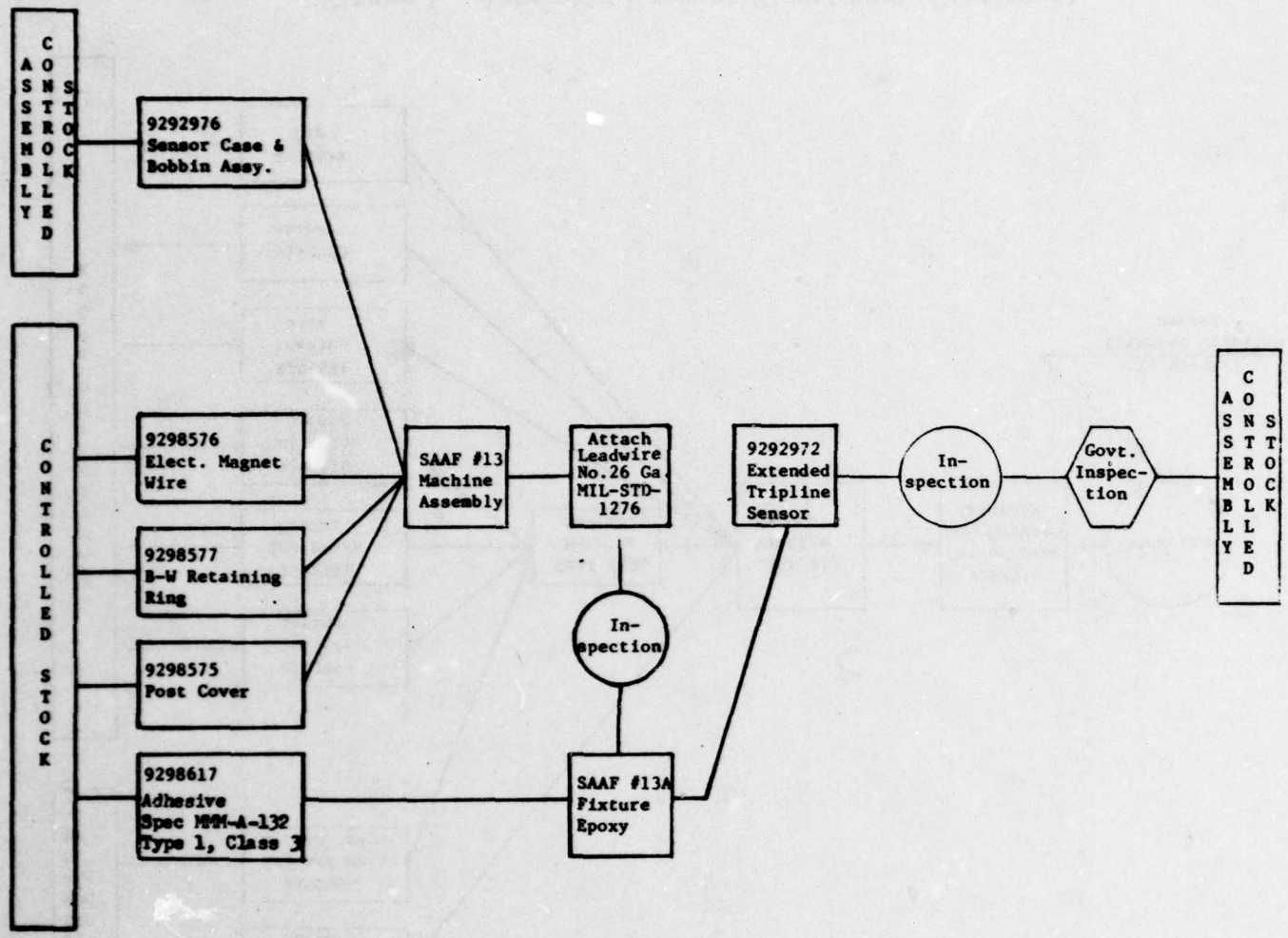

Figure 1. Assembly Process Flow Chart (Concluded)

machines would be required for the 200,000 per month capability. The improved winding station reduces this requirement to four (4) machines.

C. ENGINEERING SUPPORT

Throughout the program, reliability and safety inputs were provided to Production Engineering on a continuing basis for the PEP tasks on the Extended Tripline Sensor. Support was also provided for the Machine Development effort in the area of reliability, availability and maintainability (RAM) plus safety and human factors engineering (HFE). This resulted in optimization of the production line within the context of these speciality disciplines.

D. INSPECTION AND TEST EQUIPMENT

A listing of inspection and test equipment is presented in Section IV.D of this report. In addition to these specific items, the assembly machines are built to include probes and/or inspection stations to assure that the product meets all quality requirements. The probe stations are designated on the machine dial schematics contained in Equipment Technical Data Package Specification in Appendix B of this report.

E. COST DATA

The estimated unit product cost (UPC) of the initial baseline Extended Range Tripline Sensor was $4.51 each. The UPC for the PEP version of the sensor is $3.03 each. This shows a potential savings of $1.48 per unit or $3,552,000 for a calculated second year production quantity of 2,400,000 sensors. This savings, in reality, could be greater than the figure given. One assumption taken for the initial estimate has proved to be premature. This concerns the requirement for leadwire attachment. At the beginning of the program it was assumed that the leadwires (2) would be soldered to the sensor using an automatic assembly machine. This does not appear possible without additional machine development. Design changes in the sensor configuration will not alleviate the problem. The leadwires must be soldered to the sensor as a separate operation and this cost element appears in the post PEP UPC determination. Eventual automation can increase the savings to $1.72 for a total price of $2.79 each per unit. Tooling can be provided to improve the operation as a semi-automatic process. Putting such tooling on an automatic assembly machine does not appear feasible for initial production at this time. Continued study would be conducted during the production phase in order to develop a suitable method of doing this with automation. A concept drawing for a leadwire assembly station is included in Section IV of this report. (Ref: Figure 2). A summary of cost data is contained in Section VIII and Appendix D of this report.

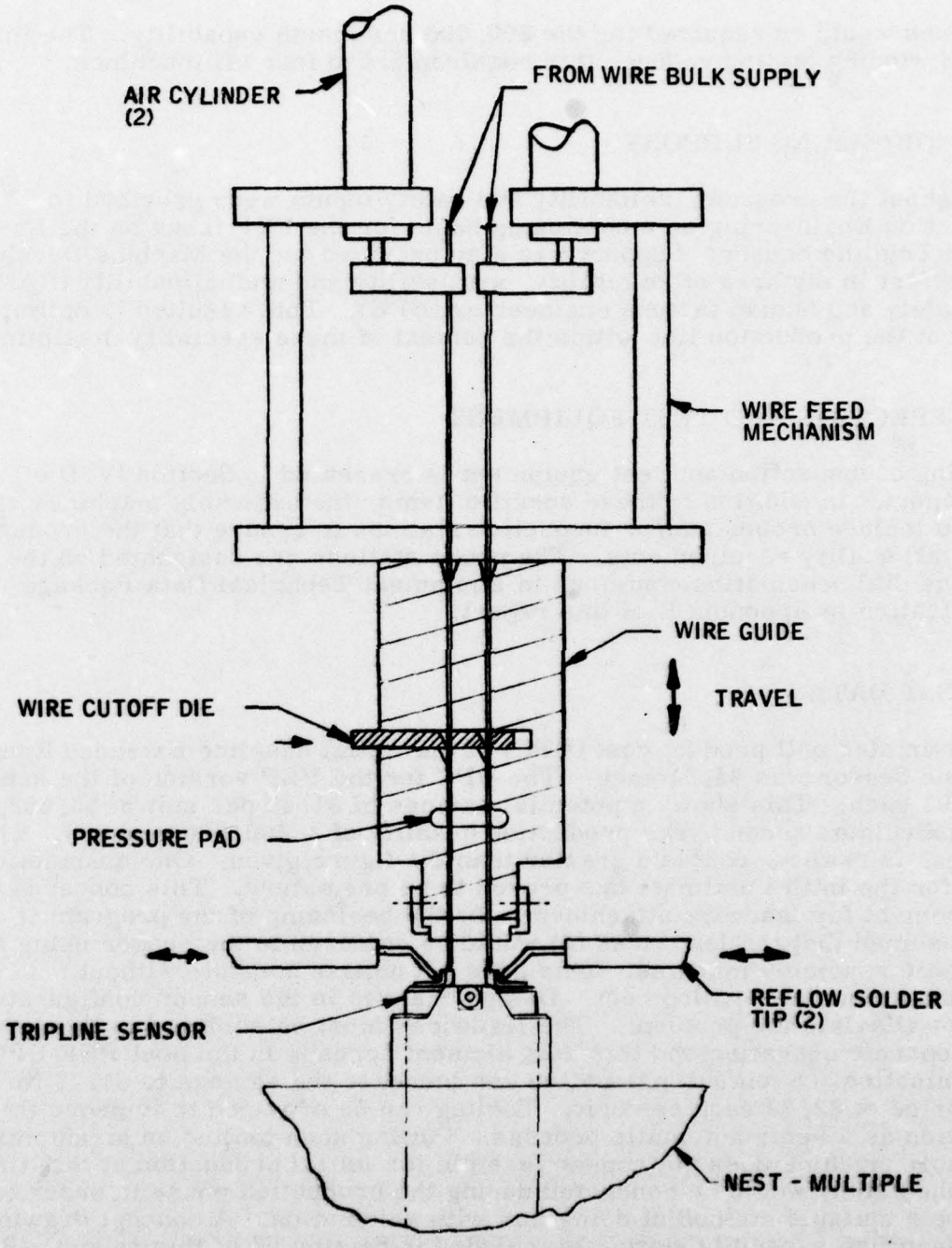

Figure 2. Leadwire Assembly Station

F. RECOMMENDATIONS

The completion of this program has provided fulfillment of specified objectives needed to describe a facility and process for an automatic assembly line to perform efficient, high volume production of reliable Extended Range Tripline Sensors which meet the quality requirements at a high confidence level and at a low cost. It is therefore recommended that the machine designs and technical documentation composed in this program be established as the initial production capability baseline design for the XM74 GEMSS Extended Range Tripline Sensor and the proposed machine line.

III. PRODUCTION ENGINEERING EFFORT

The objective of the Production Engineering effort was, to evolve a design of the GEMSS sensor suitable for economical high-volume production and compatible with safety and reliability requirements established for the parent mine. An additional objective was to achieve maximum commonality with the ADAM sensor since this would contribute to the optimum utilization of facilities to the maximum extent possible for both sensors. The GEMSS sensor Production Engineering effort was conducted in close coordination with the machine line and test equipment design task to ensure complete integration of the production line on a continuing basis.

The result of the Production Engineering effort was a number of design changes which enhanced the producibility/commonality of the sensor configuration. In the following discussion, the initial baseline design is described first in order to establish the proper setting from which the design changes, which are subsequently reported, can be clearly and easily related.

A. DESCRIPTION, INITIAL BASELINE DESIGN

The design configuration for the XM74 GEMSS Extended Tripline Sensor adopted as a baseline for the PEP program is delineated in the ARRADCOM Engineering Release Record, DRDAR-LCU-DM, No. A7N2501 dated 24 June 1977. This list has been transcribed and presented in this report as Table 2. The drawings of piece parts which have been recommended for PEP revision are indicated in the right hand column.

B. PRODUCIBILITY/COMMONALITY CHANGES

The beginning task in the PEP program consisted of an Engineering study of drawings and specifications in order to determine the changes needed to achieve automatic assembly for high volume, mass production at the lowest possible cost. The sensor subassemblies and final assembly were each evaluated in relation to the recommended changes so as to avoid any compromise in the safety and reliability of the item. A summary of the proposed changes is shown in Table 1. None of these revisions have any affect upon the commonality already existing between the ADAM Sensor and the GEMSS Sensor.

The scope and results of each of the listed changes recommended are described in the following paragraphs:

TABLE 2. BASELINE DRAWING LIST

Drawing No.	Revision Date	Nomenclature	PEP Revision
A9298576	- 77-6-24	Wire, Magnet	
A9298592	- 77-6-24	Thread, Polyester	
B9292983	B 77-6-24	Weight, Bobbin	Yes
B9298591	- 77-6-24	Tape	
B9298617	- 77-6-24	Urethane Compound	
B9298619	- 77-6-24	Paper, Gasket	
C9292981	B 77-6-24	Eyelet, Interface	Yes
C9292989	B 77-6-24	Washer, Case	Yes
C9292990	B 77-6-24	Spring, Booster	
C9292998	B 77-6-24	Diaphragm Assembly	
C9298575	- 77-6-24	Cover, Post	
C9298577	- 77-6-24	Ring, Retaining	
C9298581	- 77-6-24	Ball, Locking	
C9298582	- 77-6-24	Spring, Washer	
C9298587	- 77-6-24	Housing Assembly	
C9298589	- 77-6-24	Tube, Housing	
C9298599	- 77-6-24	Eyelet, Diaphragm	
C9298618	- 77-6-24	Gasket, Fibrous	
D9292972	B 77-6-24	Sensor, Assembly	Yes
D9292976	B 77-6-24	Sensor Case & Bobbin	Yes
D9292980	B 77-6-24	Anchor	
D9292982	B 77-6-24	Bobbin Assembly	
D9292986	B 77-6-24	Release Mech. & Case	Yes
D9292987	B 77-6-24	Case	Yes
D9292988	B 77-6-24	Sleeve	Yes
D9298578	- 77-6-24	Spring, Ejection	Yes
D9298579	- 77-6-24	Cap	
D9298586	- 77-6-24	Ring, Ball Lock	
D9298588	- 77-6-24	Cup, Housing	
D9298598	- 77-6-24	Diaphragm	
D9298601	- 77-6-24	Terminal, Breakwire	
F9292985	B 77-6-24	Bobbin	Yes
F9292991	B 77-6-24	Release Mech. Assy	
F9298597	- 77-6-24	Plate, Diaphragm	

Change Proposal No. 1

The first proposal includes the following parts and assembly:

9292983	Weight, Bobbin
9292985	Bobbin
9292982	Bobbin Assembly

The changes requested are needed to facilitate the press fit assembly of the Bobbin Weight into the Bobbin. This is accomplished by providing a taper in the Bobbin Bore and adding a radius at the ends of the weight. The benefit of these changes will be experienced as a greater yield from the assembly machine since these revisions will reduce misfeeds and shearing during the press fit assembly.

This assembly is accomplished on Machine No. 7.

The Bobbin also requires that the 0.03 slot be relocated from the 4th quadrant to the 1st quadrant in order to permit the thread to lead off in the proper direction on the assembly machine.

Change Proposal No. 2

The following piece parts are the subject of the second revision:

9292987	Case, Sensor
9292988	Sleeve
9292989	Washer Case

The Case and Sleeve are modified to include two sets of four holes each. These are construction holes which permit the use of pins which serve to retain the ejection spring and booster spring during an intermediate stage of assembly. The springs are assembled on Machine No. 12B and the remaining parts for this subassembly are added on Machine No. 12. The retaining pins hold the springs in place for transfer from 12B to 12.

The case is further modified to include four (4) flutes to act as guides during assembly of the Ejection Spring and Booster Spring. Another feature which will allow easier assembly and seating of the Booster Spring is a larger chamfer at the end of the 0.415 diameter of the case washer.

Change Proposal No. 3

Changes were requested on two more parts to reduce assembly difficulties anticipated on Assembly Machine No. 12B. These are:

9298578 Spring, Ejection
9292981 Eyelet, Interface

The Interface Eyelet is currently a brass eyelet. To assemble this eyelet requires an orientation for proper side up and also a pre-assembly with the Ejection Spring prior to assembly into the Sensor Case. A simple flat washer overcomes both of these problems without any adverse affects upon function. The ejection spring could be correspondingly simplified by not having to engage the eyelet, but a change in the spring would eliminate the commonality with the ADAM spring.

These parts are assembled on Machine No. 12B.

Change Proposal No. 4

Two assembly drawings are to be revised in order to show changes on the individual piece parts contained in these assemblies. These are:

9292986 Release Mechanism and Case Assembly
9292972 Sensor Assembly

C. *DESCRIPTION, FINAL DESIGN*

The final design as represented by the incorporation of the previously described changes is functionally identical to the pre-PEP configuration. The flutes added to the case must be limited in length so as not to interfere with the sealing and potting to be accomplished in the mine body. The use of a narrow band of shrink tubing on the outside of the Sensor Body will improve the results of the sealing and potting operation.

Certain changes are being reviewed for incorporation into the ADAM Sensor as a result of VECP activity. These changes will affect the Release Mechanism which is common to both the Extended Tripline and the ADAM Tripline. These changes do not appear to be objectionable for application to the Extended Tripline, however, no space has been given to further discussion of these changes in this report.

D. TECHNICAL DATA PACKAGE

The changes described above apply specifically to assembly operations. Machine development and prove-out of concepts have been accomplished on the basis of these recommendations. Additional problems may occur, however, these will not relate to the Sensor design with the proposed changes.

Individual piece parts are normally procured from subcontract sources and no changes have been suggested which pertain to piece part fabrication. The procurement history of 15,000 sets of parts manufactured and purchased for contract DAAA21-75-C-109 and 5,500 sets for AOMC Purchase Order D-428994-OPD did not reflect any significant fabrication problems which require drawing changes.

Quality Assurance provisions for Tripline Sensor Extended Range, QAP-GEMSS-1 (23 June 1977) has been studied and reviewed. This specification is acceptable with the following exceptions:

Reference paragraph 3.3 Non-Release

"The Sensor Assembly, when subjected to a deceleration of 5000 g's minimum, in the direction of deployment, shall not release when tested in accordance with 4.5.1.1". At the present time it is not known if the GEMSS Sensor is capable of meeting this requirement. No qualification testing has been performed as described in paragraph 4.5.1.1 at the 5000 g level. Until such a time when this is accomplished, this requirement cannot be accepted.

3.6 & 4.5.1.4

Breakwire Function

The Pull Force Rate, 3-1/4 ±3/4 inches/second (ref. 4.5.1.4) should be deleted and replaced with the following:

> "A Pull Force shall be applied smoothly and uniformly along the axis of the bobbin post and the force required for the breakwire function shall be noted."

IV. MACHINE LINE AND TEST EQUIPMENT

A. MACHINE LINE - REQUIREMENTS AND PROGRAM APPROACH

The producibility engineering and planning activities conducted on this program required the design of a machine line for the automatic assembly of the XM74 GEMSS Extended Tripline Sensor capable of producing 200,000 sensors per month, (1:8:5 schedule using a 50 minute hour and 21 days per month). The assemblies must reflect a low unit product cost and meet high reliability and safety requirements. This called for maximum utilization of contemporary technology in automated assembly machine and test equipment design to ensure maximum economy in GEMSS Extended Tripline production operations. Complete design packages have been provided for a total of 10 different machines in the following three categories:

1. Machines common to ADAM automatic assembly machines:

Machine No. 8	Diaphragm Assembly
Machine No. 9	Housing Assembly
Machine No. 10	Release Mechanism Assembly
Machine No. 10A	Terminal Assembly

2. Machines similar to ADAM Sensor machines and differing only by minor alterations:

Machine No. 11	Release Mechanism and Case Assembly
Machine No. 12	Sensor Case and Bobbin Assembly
Machine No. 13	Sensor and Breakwire Assembly
Machine No. 13A	Epoxy Dispenser

3. Machines which are new and unique to the GEMSS Extended Tripline Sensor:

Machine No. 7	Bobbin Assembly
Machine No. 12B	Sensor Case and Spring Assembly

The program approach selected was as follows:

- Conduct research into current machine technology to determine the most appropriate applications and use the results to establish the machine line.
- Prepare performance specifications for the machines selected.

- Prepare and document all designs and present them with associated costs to the Project Office.

As a result of this effort, the Project Office would receive, in effect, a machine line technical data package suitable for the Sensor initial production facility. The documentation requirements for the effort include a process description and inspection procedures.

In addition to assembly machines, certain other machines and equipment are needed for operation of the line. These items are as follows:

(1) Spring Coiler to fabricate the Ejection Spring,
(1) Spring Coiler to fabricate the Booster Spring.

DEGREASER: Barin Blakeslee
Model MSR-120
460 Volts
1/60 Phase/cycle

CONTOUR PROJECTOR: Kodak
Model 4
50-60 Cycle

DEMAGNETIZER: El Matco
Model LAC-15VB
460 Volts
50/60 Cycle

HUMIDIFIER AND TENT: Not defined

OVEN: Despatch
Model V-35 HD
440 Volts
650°F Temp
60 Cycle

MICROSCOPE: American Optical Comp.
Model 570 0.7 to 4.2X

Detailed descriptions and requirements for these machines and equipment is included in the Appendix Section of this report. This information has been prepared in accordance with Appendix B and Appendix C of specification PBM-OSM-70-1 as required in the revised scope of work for this contract.

B. DESIGN APPROACH

The assembly that is to be automated for high volume production is generally a tested and proven design either in the advanced development or production engineering stage. Because of this, Honeywell's approach in production engineering the existing product design for producibility is to minimize design changes and to emphasize modular automation concepts. The proven reliability, safety, quality, and cost reduction benefits, inherent in the automated assembly concepts developed by and in use at Honeywell, are realized when the considerations for automated assembly are incorporated into the product design.

Modification of Product Design for Automated Assembly

Design modifications that are necessary to facilitate automated assembly generally fall into the following three categories:

- Changes in Configuration to Facilitate Automated Part Orientation and/or Assembly Location - Many of the parts for an assembly have slots, holes, projections, irregular shapes, etc., that can be used by the automated assembly mechanisms to provide proper part orientation and location. Parts that do not have "identification" features can usually be modified slightly to provide the necessary configuration without affecting the basic device design or function.

- Changes in Fastener and Retaining Members to Permit Handling of Subassemblies from One Machine to the Next - The output of each machine must be secured as a module or assembly to permit handling and feeding to subsequent machines. Parts generally can be modified slightly to provide fastening or retaining means without affecting the basic product design or end function.

- Changes in Subassembly Drawings Reflecting New Assembly Sequences - Initially, the product must be broken down into logical subassemblies or modules for automatic assembly. To facilitate assembly requirements, inprocess checks and critical inspection techniques, modules are further broken down into machine operations. There is an upper limit to the number of operations that can be economically performed by any one automatic assembly machine. An optimum number of work stations for each machine can be determined by considering balance between operations on the machine, machine complexity and production capacity. Parts can usually be changed slightly to facilitate new assembly sequences without affecting the function of the end device in any manner.

Development of Assembly Sequence

To develop efficient and reliable assembly machines, the overall device must be considered in relation to its makeup and function. The first step for efficient and reliable utilization of automation is to establish an automated assembly sequence for the device based on a modular relationship with preliminary assembly and inspection operations for each module. As development progresses, the assembly operations for the machines are defined and subsequently refined to provide shortcuts and continuity. Also, features may be added to improve quality control.

The modules or assemblies resulting from the machine operations must be considered to determine the means of interim handling and transportation to the next operation. Minor subassemblies without delicate features can be handled in bulk from one machine to the hopper feeder of the next machine. Other modules require special magazines for protection as well as for maintaining orientation to the next feeding station. The design of the magazines and any special safety and handling provisions they must include are also considered throughout the assembly sequence development.

As the modules develop, their characteristics are defined in terms of assembly, function, and safety requirements. Provisions for performing safety and quality checks as part of the machine operations are incorporated wherever possible. The operations of the checking stations are reviewed to assure that all requirements are met. Redundant inspection stations are provided for all critical checks. On occasions where machine functional checks are impractical, verification provisions for inspector monitoring or sampling are made. These considerations are part of the key to efficient and reliable module machine development.

C. SPECIAL AUTOMATIC ASSEMBLY FIXTURES (SAAFS)

The assembly machines proposed for fabrication of the XM74 GEMSS Extended Range Tripline Sensor and previously referred to in Section IV.A are listed in Table 3 to show the parts assembled on each machine.

In the Summary, Section II.E, describing Cost Data, reference is made to an assembly problem relating to leadwire fastening. It is recommended that this operation be accomplished using special purpose tooling during the initial production phase of sensor manufacture. Honeywell recommends production experience in order to optimize the design of a station suitable for installation on an assembly machine. Figure 2 is a concept sketch of a bench mounted tool which would be manually loaded and cycled. This will permit refinement of the concept without interrupting machine operation.

TABLE 3. XM74 GEMSS EXTENDED RANGE TRIPLINE SENSOR ASSEMBLY MACHINES

Machine Number	Machine Name	Parts Assembled		Commonality
7	Bobbin Assembly 9292982	9292983	Weight	New
		9292985	Bobbin	
		9298591	Tape	
		9298592	Thread	
8	Diaphragm Assembly 9292998	9298597	Diaphragm Plate	Common
		9298598	Diaphragm	
		9298599	Diaph. Eyelet	
		9298618	Fibrous Gasket	
9	Housing Assembly 9298587	9298588	Housing, Cup	Common
		9298589	Housing, Tube	
10	Release Mech. Assy. 9292991 Less Terminals	9298582	Washer Spring	Common
		9298586	Ring, Ball Lock	
		9292998	Diaphragm Assy.	
		9298587	Housing Assy.	
10A	Terminal Assy. 9292991 (Release Mech. Assy.)	9298601-1	Terminal, Breakwire	Common
		9298601-2	Terminal, Breakwire	
11	Sensor Case/Sleeve Assembly 9292986	9292987	Sensor Case	Modified
		9292988	Sleeve	
		9292989	Case, Washer	
		9298581	Locking Ball	
		9292991	Release Mech. Assy.	
12B	Sensor Case/Spring Assembly	9292981	Interface Eyelet	New
		9292990	Booster Spring	
		9298578	Ejection Spring	
		9292986	Case/Sleeve Assy.	
12	Sensor Case/Bobbin Assembly 9292976	9292980	Anchor	Modified
		9298579	Cap	
		9298581	Locking Ball	
		9292986	Release Mech./Case Assy.	
		9292982	Bobbin Assembly	
13	Sensor & B/W Assy.	9298575	Post, Cover	Modified
		9298576	Magnet Wire	
		9298577	B/W Retaining Ring	
		9292976	Sensor Case/Bobbin Assy.	
13A	Epoxy Dispenser 9292972 Extended Range Tripline Sensor	9298617	Adhesive Spec. MMM-A-132 Type 1, Class 3	Modified

Tripline-Functional Outline of Leadwire Assembly Station

Assembly of the leadwires to the release mechanism terminals can be accomplished by equipment outlined in Figure 2.

Sequence of functions:

1. Feed mechanism advances wires 0.050 inch.
2. Form die anvil actuates and bends leadwires at a 90° angle.
3. Wire feed mechanism advances leadwires one-half inch (0.50).
4. Head moves down until leadwires touch terminals on release mechanism assembly.
5. Reflow solder tips move into position and reflow solder on terminals. (If insufficient solder is available on terminals a form of paste solder may have to be added in a prior step).
6. Cut off die cuts wire to predetermined length.
7. Wire guide head moves up, thus completing assembly.
8. Nest rotates, moving new part into position for sequence of operation to begin again.

A similar situation exists with the Diaphragm Assembly machine with respect to notching of the diaphragm. The first approach to this operation was to notch the diaphragm as it was being fed at the assembly station on Machine No. 8. Later study of this plan revealed too many problems, among them being orientation of the diaphragm. It is now proposed to accomplish the notching when the assembly is complete. This is the method in current use on the hand line. We have found that the hand tool built for this purpose could, in fact, be mechanized and added as the final working station on Machine No. 8. This machine could still be a "common" machine except when running ADAM Sensors the notching station would be disengaged.

Funding limitations did not permit design effort to delineate this station during the PEP program. It is suggested that this task be accomplished on the IPF program.

D. INSPECTION AND TEST EQUIPMENT

The following items of inspection and test equipment are required in the manufacture and assembly of the GEMSS Extended Tripline Sensor:

EQUIPMENT NAME	DRAWING NO.	REVISION
Deployment Fixture	H28112266-E2	B
Force and Displacement Gage	H28112270-G1	A
0.460 Dia. Go-Ring Gage	H28112271-G1	A
Spring Test Nest	H28112271-G2	A
Functional Location Gage	H28112281-G1	A
0.460 Dia. Go-Ring Gage	H28112284-G1	A
Impact Tester	No Drawing - Purchase	

V. RAM/SAFETY/HFE

The following paragraphs summarize the significant aspects of activities involving Reliability, Availability and Maintainability (RAM), Safety, and Human Factors Engineering (HFE) support during the program. Table 4 shows the associated data items completed as specified in the program.

TABLE 4. ASSOCIATED DATA ITEMS

TASKS	DATA ITEM	J	F	M	A	M	J	J	A
RAM PROGRAM PLAN	A011			▲					
HFE PROGRAM PLAN	A015			▲					
CONCEPT/DESIGN REVIEWS				CONTINUOUS AS NECESSARY					
RAM PROGRAM REPORT	A007, A010 A012 (1)						▲		
HFE TEST PLAN	A016					▲			
HFE FINAL REPORT	A018, A017 (2)								▲
SAFETY REPORTS	A020					▲	▲	▲	
RAM/SAFETY/HFE INPUTS FOR FINAL REPORT	A004								▲

(1) The RAM Report incorporated the following three program required Data Items: the RAM allocations, assessments and analysis, the Maintainability Reports, and the Maintainability Prediction Data.

(2) The HFE Report incorporated the HFE progress report and final HFE report.

A. RELIABILITY, AVAILABILITY AND MAINTAINABILITY (RAM)

1. Reliability

The primary Reliability Engineering effort was to insure that the machine line would achieve the Reliability, mean time between failures (MTBF), requirements as defined in the contract. The activities pursued to accomplish this effort are presented in the Reliability-Availability-Maintainability Program Plan which was written in response to Item A001 of the DD Form 1423 CDRL.

There was continuous participation in concept revision and changes to ensure awareness and consideration of Reliability criteria. All machine designs and specifications were reviewed for operational reliability. There was also participation in the preparation of machine performance specifications to ensure consideration of reliability requirements.

The Reliability-Availability-Maintainability Report was presented in response to Item A007, A010, and A012 of DD Form 1423 CDRL and includes the reliability (MTBF) analysis of all final machine designs. The analysis presents the predicted MTBF values for each type of machine in XM74 Tripline Sensor Machine Line. The prediction is based on data and prediction methods recently developed at Honeywell and currently used on the ADAM Mine Machine Contract, DAAK10-77-C-0018. All machines have surpassed the predicted MTBF's beyond the contract requirement which is a MTBF = 7 hours, the design goal.

2. Availability

The primary objective was to ensure that the machine line would achieve the availability requirements defined in the contract as 85 percent under ideal conditions, i.e., trained personnel, repair parts and tools readily available, etc. The contract further defined a production rate of 200,000 units/month on a 1-8-5 shift bases using a 50 minute hour and 21 days per month. These were the assumptions used in the availability analysis of the machine line.

Availability activities that were followed in this program are presented in the Reliability-Availability-Maintainability Program Plan. Machine concepts, including station descriptions and dial layouts, were reviewed for availability considerations. There was also continuous participation in all concept reviews and changes to ensure awareness and consideration of availability criteria.

Predictions were made of each machine's availability using data and prediction methods recently developed at Honeywell and currently used on the ADAM Mine Machine Contract DAAK10-77-C-0018. All machines had a predicted availability as good or better than the contract requirement. The result of the availability analysis and predictions were presented in the Reliability-Availability-Maintainability Report.

3. Maintainability

The primary objective was to ensure that the machine line would achieve the maintainability, mean time to repair (MTTR), requirements as defined in the contract. The maintainability efforts were closely associated with the reliability and availability activities discussed in the previous paragraphs. The tasks that were followed to reach this objective are presented in the Reliability-Availability-Maintainability Program Plan. This included continuous participation in concept reviews and changes to ensure awareness and consideration of Maintainability criteria. All machine designs and specifications were reviewed for maintainability requirements.

The Reliability-Availability-Maintainability Report was presented in response to Items A007, A010 and A012 of the DD Form 1423 CDRL and includes the maintainability (MTTR) analysis of the final machine designs. The analysis develops predicted MTTR values for each type of machine used in the XM74 Tripline Sensor Machine Line. These values were presented in the RAM Program Report. The prediction is based on data and prediction methods recently developed at Honeywell and currently used on the ADAM Mine Machine Contract DAAK10-77-C-0018.

Other maintainability activities during the program were developing machine guidelines for the performance specifications, monitoring design activities, reporting concerns and progress, maintaining liaison with other program personnel and reviewing plans for future program plans.

B. SAFETY

The Safety Engineering activities were closely coordinated with the Human Factors Engineering activities. These safety activities primary involved concern for safety of personnel associated with the automated equipment i.e., operators, maintenance personnel, observers, etc. The safety effort in support of machine design activities encompassed initial reviews of the requirements, definition of guidelines for use in design and incorporation of safety criteria in the specifications including requirements established by the Occupational Safety and Health Administration (OSHA).

A Safety Analysis and Hazardous Failure Mode Analysis was performed for each machine and documented in Safety Analysis and Hazard Evaluation Reports in response to Item A020 of the DD Form 1423 CDRL. This analysis included a review of the information generated for a similar data item under the ADAM Mine Machine Contract DAAK10-77-C-0018 with modifications thereto based on equipment design features peculiar to the GEMSS Extended Tripline Sensor. A separate report was written for each type of machine used in the proposed production line.

C. HUMAN FACTORS ENGINEERING (HFE)

The objective of the HFE effort was to maximize the human factors effectiveness of the machine line and thus ensure high efficiency in all man-machine interactions. The HFE activities were coordinated with the Safety and RAM activities to establish an efficient and effective effort. HFE Machine Design guidelines were developed based on program requirements and objectives, experience with other machine lines, military specifications and standards and sources outside Honeywell relative to HFE evaluation of machine production lines. These guidelines and planned HFE activities were presented in the HFE Program Plan in response to Item A015 of the DD Form 1423 CDRL.

All design and specification activities for the unique and modified machines were monitored to ensure appropriate consideration for human factors. Existing ADAM Mine Machines, contract DAAK10-77-C-0018, used in this program were reviewed for possible HFE improvements. The machine drawings and specifications of the unique and modified machines used in the machine line were reviewed for HFE features and considerations. The HFE analysis is documented in the Human Factors Engineering Report in response to Item A018 and A017 of the DD Form 1423 CDRL.

A Human Factor Test Plan, in response to Item A016 of the DD Form 1423 CDRL, was written. It provides a general outline of test procedures to follow that may be used in a later phase to evaluate the HFE characteristics of the GEMSS XM74 Extended Tripline Sensor production machines.

To summarize, the following data items have been submitted as referenced in this section:

Data Ref. No.	Date Submitted	Report
A004	31 August	Final Report
A007	15 June	TECH/PERF No. 12
A010	15 June	TECH/PERF No. 12
A011	28 April	TECH/PERF No. 10
A012	15 June	TECH/PERF No. 12
A015	28 April	TECH/PERF No. 10
A016	15 June	TECH/PERF No. 12
A017	30 March	TECH/PERF No. 9
A018	31 August	Final Report
A020	15 June	TECH/PERF No. 12

VI PROCESS DESCRIPTION

A. SUMMARY

The assembly process flow chart is shown in Figure 1. Copies of the Production Process Summary layouts are included on the pages following. These describe the process for assembly of the XM74 GEMSS Sensor.

In addition, there are certain special process requirements currently in use for the ADAM Sensor which are applicable to the Extended Tripline Sensor. These are as follows:

- Harparizing - The Spring Washer is deburred in a Harparizer machine. This special tumbling is done on all lots to assure uniform, burr free parts for proper function of the Sensor.

- Water Bath and Humidity Chamber - The Bobbin, being made of nylon material is subject to becoming brittle in the winter season due to low humidity in the factory. To correct this problem, the *Bobbin piece parts are soaked in water for 8 hours before winding* thread on the bobbin core.

  The same problem exists when the retaining ring is placed on the bobbin post. This problem is resolved by soaking the Sensor Assemblies in a humidity chamber a minimum of 2 hours prior to machine assembly of the retaining ring.

- X-Ray - The Release Mechanism, and Case Assembly, and the Sensor Case and Bobbin Assembly require Process Controls where X-Raying is employed to determine position and presence of various componentry.

B. PROCESS SUMMARY LAYOUTS

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PRODUCTION PROCESS SUMMARY

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DIST. CODE	END ITEM (DEVICE)	REVISION	ISSUE DATE MO DA YR	E.E. INIT	PART NAME	PART NUMBER
C1	GEMSS-SENSOR	+	8/29/78	RLF	DIAPHRAGM ASSEMBLY	9292998-001

TRAN CODE	OPERATION NUMBER	ISSUE NO.	DEPT.	GRP	OPERATOR STANDARD HRS/M	SET-UP	OPERATION TITLE / TRANSACTION CODE / QUANTITY REQUIRED / UNIT MEAS / CALLOUT NUMBER / TRACK CODE / CALLOUT DESCRIPTION	PIECES/HOUR	OPER LOAD	P.E. INIT
	001X						PURCHASE MATERIAL:			
							L0 MATERIAL: PAPER , #4 SULFITE BOND			
							L1 WHITE, .003 THICK, 16 LB. WT.			
							L2 (2.25 IN WIDE ADDING MACHINE TAPE			
							L3 #7786 NATION WIDE PAPER CO., MPLS., MINN.			
							REF: 9298619			
	020A						MACHINE ASSEMBLE DIAPHRAGM TO PLATE			
							F 15 33.4 9298618-001 GASKET FIBROUS			
							F 20 1 9298598-001 DIAPHRAGM			
							F 26 1 9298599-001 EYELET			
							F 26 1 9298597 PLATE DIAPHRAGM			
	020J						PROCESS CONTROL			
	024M						SORT PARTS FROM #8 MACHINE			
							L0 AND SEGREGATE PARTS TO			
							L1 PROPER CONTAINERS.			

CONT. NEXT PAGE - 9292998-001

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L0 THROUGH L9 = REMARKS

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C1	GEMSS-SENSOR	+	8/29/78		DIAPHRAGM ASSEMBLY	9292998 -001

TRAN CODE	OPERATION NUMBER	ISSUE NO.	DEPT.	GRP	OPERATOR STANDARD HRS/M	SET-UP	OPERATION TITLE / TRANSFER QUANTITY REQUIRED / UNIT MEAS / CALLOUT NUMBER / TRACE CODE / CALLOUT DESCRIPTION	PIECES/HOUR	OPER LOAD	P.F. INIT
	033M						SORT FOR DEFECTIVE PARTS			
	034M						SORT FOR .016-.019 DIMENSION			
	039S						INSPECT PER I.P.			
							END OF PROCESS 9292998-001			

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C1	END ITEM (DEVICE)	REVISION	ISSUE DATE MO DA YR	I.E. INIT	PART NAME	PART NUMBER
	GEMSS-SENSOR	+	8/29/78	RLF	HOUSING ASSEMBLY	9298587

TRAN CODE	OPERATION NUMBER	ISSUE NO.	DEPT.	GRP	OPERATOR STANDARD HRS/M	SET-UP	OPERATION TITLE / TRANSACTION CODE / QUANTITY REQUIRED / UNIT MEAS / CALLOUT NUMBER / TRACK CODE / CALLOUT DESCRIPTION	PIECES/HOUR	OPER LOAD	P.R. INIT
	010A						MACHINE ASSEMBLE TUBE TO HOUSING			
							F 20 1 9298589 TUBE, HOUSING			
							F 26 1 9298588 CUP, HOUSING			
	010J						PROCESS CONTROL			
	014M						SORT PARTS-RESTAKE ASSEMBLIES			
	019S						INSPECT PER I.P.			
							END OF PROCESS			

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	GEMSS-SENSOR	+	8/29/78	RLF	RELEASE MECH. ASSEMBLY	9292991-001

TRAN CODE	OPERATION NUMBER	ISSUE NO.	DEPT.	GRP	OPERATOR STANDARD HRS/M	SET-UP	OPERATION TITLE / TRANSACTION CODE	QUANTITY REQUIRED	UNIT MEAS	CALLOUT NUMBER	TRACK CODE	CALLOUT DESCRIPTION	PIECES/HOUR	OPER LOAD	P.E. INIT
	010A						MACHINE ASSEMBLE DIAPHRAGM AND HOUSING ASSEMBLY								
							F	20	2	9298582		SPRING WASHER			
							F	20	1	9298587		HOUSING ASSEMBLY			
							F	20	1	9292998		DIAPHRAGM ASSEMBLY			
							F	26	1	9298586		RING, LOCK			
	010J						PROCESS CONTROL								
	014M						SORT PARTS FROM REJECT-EJECT BIN								
	014S						INSPECT PER I.P.								
	020A						MACHINE ASSEMBLE TERMINAL BW'S								
							F	20	1	9298601-001		TERMINAL R.H.			
							F	20	1	9298601-002		TERMINAL L.H.			
	020J						PROCESS CONTROL								

CONT. NEXT PAGE 9292991

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	GEMSS-SENSOR	+	8/29/78	RLF	RELEASE MECH. ASSEMBLY	9292991-001

TRAN CODE	OPERATION NUMBER	ISSUE NO.	DEPT.	GRP	OPERATOR STANDARD HRS/M	SET-UP	OPERATION TITLE / TRANSACTION CODE / QUANTITY REQUIRED / UNIT MEAS / CALLOUT NUMBER / TRACE CODE / CALLOUT DESCRIPTION	PIECES/HOUR	OPER LOAD	P.E. INIT
	024M						SORT .157 ± .002 DIMENSION			
	029M						"X" RAY FOR SPRING WASHER POSITION			
	029S						INSPECT PER I.P.			
							END OR PROCESS			

40

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TRAN CODE	END ITEM (DEVICE)	REVISION	ISSUE DATE MO DA YR	E.INIT	PART NAME	PART NUMBER
C1	GEMSS- SENSOR	+	8/29/78	RLF	BOBBIN ASSEMBLY	9292982

TRAN CODE	OPERATION NUMBER	ISSUE NO.	DEPT.	GRP	OPERATOR STANDARD HRS/M	SET-UP	OPERATION TITLE / TRANSACTION CODE / ITEM TYPE / QUANTITY REQUIRED / UNIT MEAS / CALLOUT NUMBER / TRACK CODE / CALLOUT DESCRIPTION	PIECES/HOUR	CREW LOAD	P.E. INIT
	001X						PRUCHASED MATERIAL			
							LO THREAD, POLYESTER, OLIVE GREEN .005 MAX. DIA.			
							L1 1.8 LB MIN. BREAK STRENGTH 100% POLYESTER			
							L2 SOURCE COATS AND CLARK - SEE PRINT 9298592			
							L3 .84 LBS/M			
							L4 TAPE 3M CO. #853 3/4 WIDE - SEE PRINT 9298591			
							L5 24 YDS/M			
							L6 OIL, MARVEL MYSTERY, PORT CHESTER N.Y.			
							L7 .05 QT/M			
							L8 MC8225-01 SEALANT REF: XPE 403 AS REQUIRED			
	010A						BOBBIN WIND MACHINE ASSEMBLY #7			
							F 10 .05 QTM MARVEL MYSTERY OIL OIL			
							F 26 .0004 LB 9298592-001 THREAD POLYESTER			
							F 26 1 EA. 9292985-001 BOBBIN			
							F 26 1 EA. 9292983 WEIGHT BOBBIN			
							F 26 6 YD 9298591 TAPE (.10 DIA.)			

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OPERATIONAL TRAVELER { Y = YES / N = NO

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2	P01

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C1	END ITEM (DEVICE)	REVISION	ISSUE DATE MO DA YR	I.E. INIT	PART NAME		PART NUMBER
	GEMSS-ETL-SENSOR	+	8/29/78	RLF	BOBBIN ASSEMBLY		9292982

TRAN CODE	OPERATION NUMBER	ISSUE NO.	DEPT.	GRP	OPERATOR STANDARD HRS/M	SET-UP	OPERATION TITLE	PIECES/HOUR	OPER LOAD	P.R. INIT

TRANSACTION CODE/TYPE	QUANTITY REQUIRED	UNIT MEAS	CALLOUT NUMBER	TRACK CODE	CALLOUT DESCRIPTION

	015M						SORT BOBBIN ASSEMBLIES AND REPAIR		
	017S						INSPECT PER I.P.		
	020A						LOAD BOBBINS TO MAGAZINES		

42

TRANSACTION CODES
C2 = COMPLETE OP DELETE
C3 = ADD OP NOT CURRENTLY ON PROCESS, OR COMPLETELY REWRITE EXISTING OP TITLE LINE AND DELETE ALL EXISTING CALLOUTS AND REMARKS
NEW CALLOUTS AND REMARKS MUST BE ADDED WITH F&L TRANSACTIONS
C4 = REVISE EXISTING OP TITLE LINE ONLY - EXCEPT OP NO.

HP-431 (BOND) HP-431A (2 PART) REV 4/77

TRANSACTION CODES
F2 = COMPLETE CALLOUT DELETE
F3 = ADD NEW CALLOUT OR REVISE EXISTING CALLOUT EXCEPT CALLOUT NO.
L0 THROUGH L9 = REMARKS

STANDARD KEYPUNCH CHARACTERS
ABCDEFGHIJKLMNOPQRSTUVWXYZ
.,()-/+$¢%-;":@><#='*1234567890

P636

PRODUCTION PROCESS SUMMARY

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OPERATIONAL TRAVELER { Y = YES N = NO

MACHINE #11

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TRAN CODE	DIST. CODE	END ITEM (DEVICE)	REVISION	ISSUE DATE MO DA YR	I.E. INIT	PART NAME	PART NUMBER
C1		GEMSS-SENSOR	F +	8/29/78	RLF	REL. MECH. AND CASE ASSEMBLY	9292986

TRAN CODE	OPERATION NUMBER	ISSUE NO.	DEPT.	GRP	OPERATOR STANDARD HRS/M	SET-UP	OPERATION TITLE / TRANSACTION CODE	QUANTITY REQUIRED	UNIT MEAS	CALLOUT NUMBER	TRACK CODE	CALLOUT DESCRIPTION	PIECES/HOUR	OPER LOAD	P.E. INIT
	010A						MACHINE ASSEMBLE								
							F	20	1	9292991		RELEASE MACHINE ASSEMBLY			
							F	26	4	9298581		BALL, LOCKING			
							F	26	1	9292987		CASE SENSOR			
							F	26	1	9292988		SLEEVE			
							F	26	1	9292989		WASHER, CASE			
	020A						X-RAY								
	029S						INSPECT PER I.P.								
							END OF PROCESS 9292986								

43

TRANSACTION CODES
C2 = COMPLETE OP DELETE
C3 = ADD OP NOT CURRENTLY ON PROCESS, OR COMPLETELY REWRITE EXISTING OP TITLE LINE AND DELETE ALL EXISTING CALLOUTS AND REMARKS
NEW CALLOUTS AND REMARKS MUST BE ADDED WITH F&L TRANSACTIONS
C4 = REVISE EXISTING OP TITLE LINE ONLY - EXCEPT OP NO.

TRANSACTION CODES
F2 = COMPLETE CALLOUT DELETE
F3 = ADD NEW CALLOUT OR REVISE EXISTING CALLOUT EXCEPT CALLOUT NO.
L0 THROUGH L9 = REMARKS

STANDARD KEYPUNCH CHARACTERS
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HP-431 (BOND) HP-431A (2 PART) REV 4/77

P835

PRODUCTION PROCESS SUMMARY

☐ NEW

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OPERATIONAL TRAVELER { Y = YES / N = NO

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TRAN CODE	END ITEM (DEVICE)	REVISION	ISSUE DATE MO DA YR	I.E. INIT	PART NAME	PART NUMBER
C1	GEMSS-ETL-SENSOR	+	8/29/78	RLF	CASE-SLEEVE-SPG-ASSEMBLY	9292976-SA

TRAN CODE	OPERATION NUMBER	ISSUE NO.	DEPT.	GRP	OPERATOR STANDARD HRS/M	SET-UP	OPERATION TITLE	PIECES/HOUR	OPER LOAD	P.E. INIT
	010A						MACHINE ASSEMBLY #12B			

TRANSACTION CODE	QUANTITY REQUIRED	UNIT MEAS	CALLOUT NUMBER	TRACK CODE	CALLOUT DESCRIPTION
F 20	1 ea.		9292986		REL. MECH.-CASE ASSEMBLY
F 20	1 ea.		9292990		SPRING, BOOSTER
F 20	1 ea.		9292981		WASHER
F 20	1 ea.		9298578		SPRING, EJECTION

44

TRANSACTION CODES
C2 = COMPLETE OP DELETE
C3 = ADD OP NOT CURRENTLY ON PROCESS, OR COMPLETELY REWRITE EXISTING OP TITLE LINE AND DELETE ALL EXISTING CALLOUTS AND REMARKS
NEW CALLOUTS AND REMARKS MUST BE ADDED WITH F&L TRANSACTIONS
C4 = REVISE EXISTING OP TITLE LINE ONLY - EXCEPT OP NO.

TRANSACTION CODES
F2 = COMPLETE CALLOUT DELETE
F3 = ADD NEW CALLOUT OR REVISE EXISTING CALLOUT EXCEPT CALLOUT NO.
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STANDARD KEYPUNCH CHARACTERS
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HP-431 (BOND) HP-431A (2 PART) REV 4/77

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DIST. CODE	END ITEM (DEVICE)	REVISION	ISSUE DATE MO DA YR	I.E. INIT	PART NAME	PART NUMBER
C1	GEMSS-SENSOR	+	8/29/78	RLF	SENSOR CASE AND BOB. ASSM.	9292976

TRAN CODE	OPERATION NUMBER	ISSUE NO.	DEPT.	GRP	OPERATOR STANDARD HRS/M	SET-UP	OPERATION TITLE / PIECES/HOUR / OPER LOAD / P.R. INTY	FEATURE CODE	QUANTITY REQUIRED	UNIT MEAS	CALLOUT NUMBER	TRACE CODE	CALLOUT DESCRIPTION
	010A						MACHINE ASSEMBLY #12						
								F	20	1 ea.	9292976-SA		CASE-SLEEVE-SPG. ASSM.
								F	20	1 ea.	9292982		BOBBIN ASSEMBLY
								F	201	1 ea.	9292980		ANCHOR
								F	26	2 ea.	9298581		BALL, LOCKING
								F	26	1 ea.	9298579		CAP
	015M						SORT FOR DAMAGED CAP						
	030A						X-RAY FOR 2 CENTER BALLS						
	039S						INSPECT AND SALT X-RAY						
							END OF PROCESS 9292976						

45

TRANSACTION CODES
C2 = COMPLETE OP DELETE
C3 = ADD OP NOT CURRENTLY ON PROCESS, OR COMPLETELY REWRITE EXISTING OP TITLE LINE AND DELETE ALL EXISTING CALLOUTS AND REMARKS
NEW CALLOUTS AND REMARKS MUST BE ADDED WITH F&L TRANSACTIONS
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F2 = COMPLETE CALLOUT DELETE
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STANDARD KEYPUNCH CHARACTERS
ABCDEFGHIJKLMNOPQRSTUVWXYZ
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HP-431 (BOND) HP-431A (2 PART) REV 4/77

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OPERATIONAL TRAVELER (Y = YES / N = NO)

MACHINE #13/13A

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TRANS CODE	END ITEM (DEVICE)	REVISION	ISSUE DATE MO DA YR	I.E. INIT	PART NAME	PART NUMBER
C1	GEMSS-SENSOR	+	8/29/78	RLF	SENSOR ASSEMBLY	9292972

TRANS CODE	OPERATION NUMBER	ISSUE NO.	DEPT.	GRP	OPERATOR STANDARD HRS/M	SET-UP	OPERATION TITLE / TRANSACTION CODE / QUANTITY REQUIRED / UNIT MEAS / CALLOUT NUMBER / TRACK CODE / CALLOUT DESCRIPTION	PIECES/HOUR	OPER LOAD	P.I. INIT
	001X						PURCHASED MATERIAL			
							L0 WIRE, MAGNET, ELECTRICAL .0040 ± .0001			
							L1 PER MIL-W-583 ELONGATION PER PAR 3.3/4.7.2			
							L2 ADHERENCE PER PAR 3.2.2.2/4.7.10.1/4.7.10.2			
							L3 SEE PRINT 9298576 500 FT/M			
							L4 ADHESIVE SPEC MMM-A-132			
							L5 TYPE 1 - CLASS 3			
							L6 MC8119-01 SOLDER SN63 RMA			
							L7 3.3% CORE, .025 DIA.			
							L8 MC7849-001 FLUX			
							L9 WIRE, TINNED COPPER MIL-STD-1276 NO. 26 GAGE			
	005M						FLATTEN TERMINALS			
	006M						ADD SOLDER TO TERMINALS			
	010A						MACHINE ASSEMBLY #13			
							F 20 1 ea. 9292976 SENSOR CASE/BOBBIN			

TRANSACTION CODES
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NEW CALLOUTS AND REMARKS MUST BE ADDED WITH F&L TRANSACTIONS
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F2 = COMPLETE CALLOUT DELETE
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STANDARD KEYPUNCH CHARACTERS
ABCDEFGHIJKLMNOPQRSTUVWXYZ
.,()+/+$¢%-;":@><#='*1234567890

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P635

PRODUCTION PROCESS SUMMARY

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MACHINE #13/13A

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C1	END ITEM (DEVICE)	REVISION	ISSUE DATE MO DA YR	I.E. INIT	PART NAME	PART NUMBER
	GEMSS-SENSOR	H+	8/29/78	RLF	SENSOR ASSEMBLY	9292972

TRAN CODE	OPERATION NUMBER	ISSUE NO.	DEPT.	GRP	OPERATOR STANDARD HRS/M	SET-UP	OPERATION TITLE / TRANSLATION CODE	QUANTITY REQUIRED	UNIT MEAS	CALLOUT NUMBER	TRACE CODE	CALLOUT DESCRIPTION	PIECES/HOUR	OPER LOAD	O.E. INIT
	010A	(CONT)					F	26 1		9298575		POST, COVER			
							F	26 1		9298577		RING RET. B.W.			
							F	26 500	YD	9298576		WIRE MAGNET ELECTRIC			
	012S							INSPECT BREAKWIRE							
	014A							HAND SOLDER LEAD WIRE TO 2 TERMINALS							
							F	26 250	FT.			WIRE, TINNED COPPER			
	015A														
	015A							BRUSH CLEAN SOLDER CONNECTIONS WITH ALCOHOL							
	016M							SORT DAMAGED PARTS							
	019S							INSPECT PER I.P.							
	020A							APPLY EPOXY SAAF NO. 13A							
	025M							SORT EXCEPT EPOXY							
	029S							INSPECT PER I.P.							

47

TRANSACTION CODES
C2 = COMPLETE OP DELETE
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ABCDEFGHIJKLMNOPQRSTUVWXYZ
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HP-431 (BOND) HP-431A (2 PART) REV 4/77

VII. QUALITY ASSURANCE

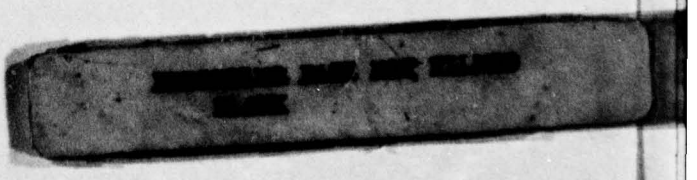
Inspection Procedures were generated for each material, piece part, subassembly, and final assembly on the Extended Tripline Sensor Drawing List, applying the Quality Assurance provisions developed under Contract DAAA-73-C-0070 and QAP-GEMSS-1, dated 23 June 1977, and are included as Appendix C.

Quality Engineering, in conjunction with the other Honeywell engineering disciplines, developed the necessary inspection equipment designs which were prepared in response to Item A008 of the DD Form 1423 CDRL.

Quality Engineering Acceptance Equipment Operation Instructions and the Calibration Program and Data Record were prepared in response to Items A013 and A014 to the DD Form 1423 CDRL.

There was continuous participation by Quality Engineers with the Machine Designers, Production Engineers, and Reliability Engineers on machine design tasks to assure that the special automatic assembly fixtures (SAAF's) met the requirements and considerations of the Scope of Work. Quality Assurance Demonstration Plans were prepared for each of the ten (10) SAAF's. These were prepared in response to Item A009 of the DD Form 1423 CDRL.

The plans detail Honeywell verification of the SAAF, which includes: identification areas, operation, controls, preliminary run and log book verification. These plans also include the demonstration test, which includes: items addressed preceding the demonstration test, during the test and following the test. Also included with Item A009 is a General Procedure for Demonstration Test that describes the duties of each discipline during the conduct of a demonstration test. The General Procedure also addresses special situations, such as administrative stoppage, a RAM failure, and termination of test for unsatisfactory SAAF performance.



VIII. CONCLUSIONS AND RECOMMENDATIONS

The XM74 GEMSS Extended Range Tripline Producibility Engineering and Planning Program has been successful in reducing the unit product cost of the GEMSS Sensor by incorporating changes to permit automation. The degree of automation can be extended as experience is gained in actual production as in the case of leadwire soldering. It is believed that this improvement must be done in a production environment in order to properly identify and establish the working parameters for a successful soldering station.

The PEP program has provided complete designs for ten (10) SAAF's for automatic assembly of the GEMSS Sensor. Machine concepts for new stations were built in the lab and proved out for reliability and establish a high confidence level in the design.

The PEP program has provided a complete Quality package conveying all aspects of machine build and acceptance as well as quality data for sensor production.

The PEP program has provided coordinated inputs in the area of RAM, Human Factors Engineering, and Safety for the Extended Tripline facility. This facility has been fully delineated including the factory floor plan and necessary support equipment.

The production facility costs are also presented in detail in Appendix D which includes separate cost information for debug and machine demonstration hardware.

Based upon these accomplishments it is recommended that this information be used for defining the Initial Production Facility for GEMSS Sensor production.

APPENDIX A

EQUIPMENT FUNCTIONAL CRITERIA SPECIFICATION
FOR
SPECIAL AUTOMATIC ASSEMBLY LINE
FOR XM74 GEMSS EXTENDED TRIPLINE SENSOR

SPECIFICATION FS 578-4869

ORIGINAL ISSUE

DARCOM Project
578-4869

AUGUST 1978

Preparing Organization

Honeywell Inc.
Defense Systems Division

94580

EQUIPMENT FUNCTIONAL CRITERIA SPECIFICATION
TABLE OF CONTENTS

EQUIPMENT FUNCTIONAL CRITERIA SPECIFICATION
TABLE OF CONTENTS (Concluded)

1.0 SCOPE

This equipment functional criteria specification establishes the technical and mission requirements, allocates functional area requirements for the process, identifies interfaces and specifies individual pieces of equipment which are to be configuration items for special automatic assembly of the XM74 GEMSS Extended Tripline Sensor.

This equipment is tabulated (ref. Table A-1) which shows each machine by name and number, a listing of parts assembled and commonality with ADAM Sensor Assembly Machines.

2.0 APPLICABLE DOCUMENTS

2.1 Government Documents

The following documents of the issue in effect on the date of beginning activity on this contract shall form a part of this specification to the extent specified herein:

Standards

MIL-STD-1472	Human Engineering Design Criteria for Military Systems, Equipment, and Facilities

Drawings

9292972	Extended Range Tripline Sensor
QAP-GEMSS-1	Specification Extended Range Tripline Sensor

TABLE A-1. GEMSS EXTENDED RANGE TRIPLINE SENSOR ASSEMBLY MACHINES

Machine Number	Machine Name	Parts Assembled		Commonality
7	Bobbin Assembly 9292982	9292983	Weight	New
		9292985	Bobbin	
		9298591	Tape	
		9298592	Thread	
8	Diaphragm Assembly 9292998	9298597	Diaphragm Plate	Common
		9298598	Diaphragm	
		9298599	Diaph. Eyelet	
		9298618	Fibrous Gasket	
9	Housing Assembly 9298587	9298588	Housing, Cup	Common
		9298589	Housing, Tube	
10	Release Mech. Assy. 9292991 Less Terminals	9298582	Washer Spring	Common
		9298586	Ring, Ball Lock	
		9292998	Diaphragm Assy.	
		9298587	Housing Assy.	
10A	Terminal Assy. 9292991 (Release Mech. Assy.)	9298601-1	Terminal, Breakwire	Common
		9298601-2	Terminal, Breakwire	
11	Release Mech. and Case Assembly 9292986	9292987	Sensor Case	Modified
		9292988	Sleeve	
		9292989	Case, Washer	
		9292581	Locking Ball	
		9292991	Release Mech. Assy.	
12B	Release Mech. and Case Assembly 9292986 (Partial)	9292981	Interface Eyelet	New
		9292990	Booster Spring	
		9298578	Ejection Spring	
		9292986	Case/Sleeve Assy.	
12	Sensor Case/Bobbin Assembly 9292976	9292980	Anchor	Modified
		9298579	Cap	
		9298581	Locking Ball	
		9292986	Release Mech./Case Assy.	
		9292982	Bobbin Assembly	
13	Sensor & B/W Assy.	9298575	Post, Cover	Modified
		9298576	Magnet Wire	
		9298577	B/W Retaining Ring	
		9292976	Sensor Case/Bobbin Assy.	
13A	Epoxy Dispenser 9292972 Extended Range Tripline Sensor		Adhesive Spec. MMM-A-132 Type 1, Class 3	Modified

2.2 Non-Government Documents

Not applicable.

3.0 REQUIREMENTS

3.1 Manufacturing Line Definition

3.1.1 General Description -- The basic manufacturing line will consist of ten automatic assembly machines and two spring winders which will assemble individual piece parts and/or subassemblies for the XM74 Extended Range Tripline Sensor Program. The manufacturing line flow is shown in Figure A-1. The output product of each machine is directly acceptable to the machine following in sequence so as to maintain continuity throughout the manufacturing line.

3.1.2 Capability -- A complete manufacturing line, consisting of one each of the ten automatic assembly machines, would have as a nominal line rate the following capability when expressed at the maturity levels indicated:

Cumulative production at	100,000 total	30,000 sensors/mo.
	500,000 total	45,000 " "
	1,000,000 total	55,000 " "

The line output capacities have been adjusted for efficiency, scrap and salvage and the values expressed are net output of sensors delivered.

The limiting machine in the overall line production rate is the Bobbin Assembly Machine. This machine is a line limiter until three Bobbin Assembly Machines are available when other machines become the pacing item with a limiting output as follows:

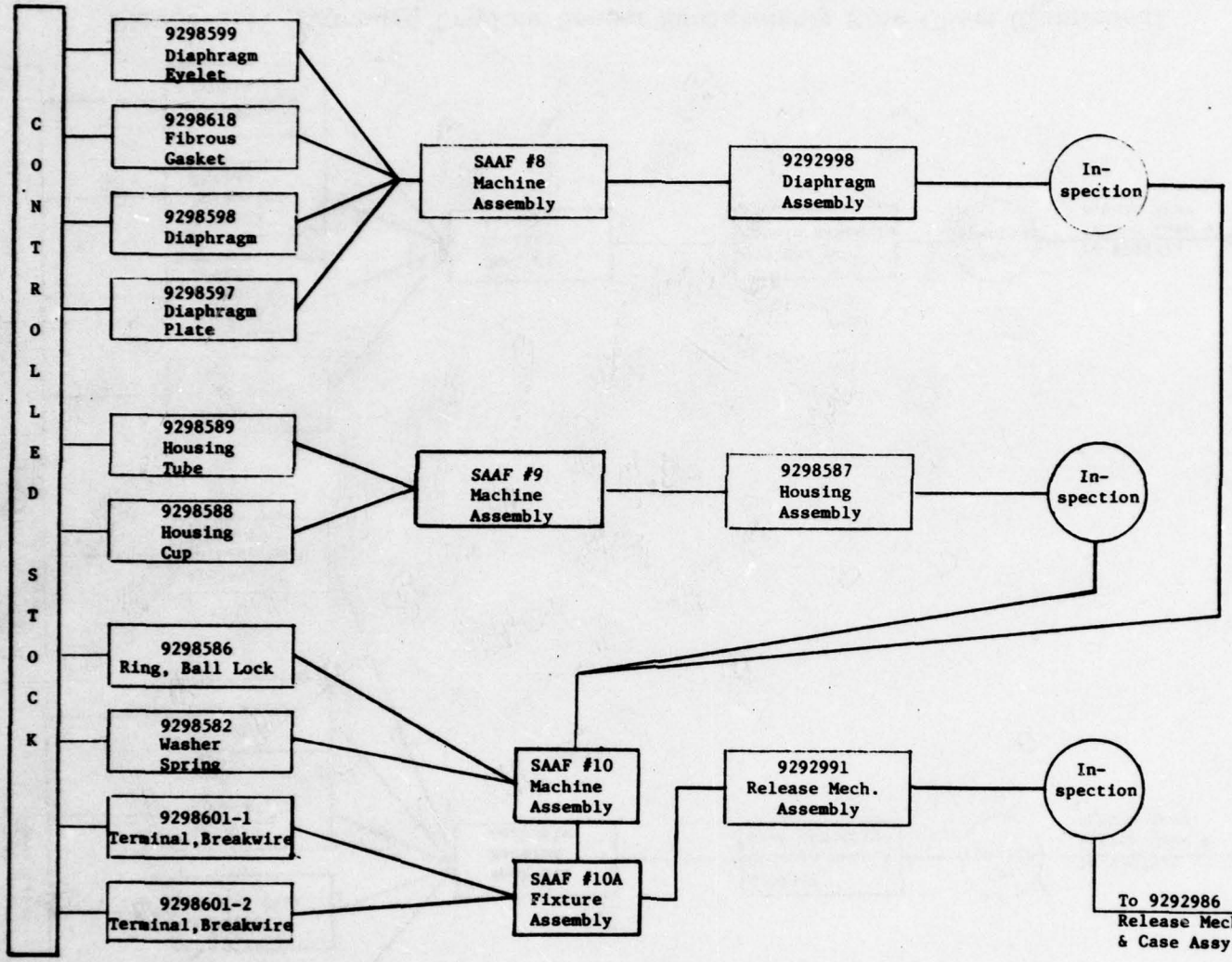


Figure A-1. Extended Tripline Sensor Subassembly Flow Chart

FS 578-4869

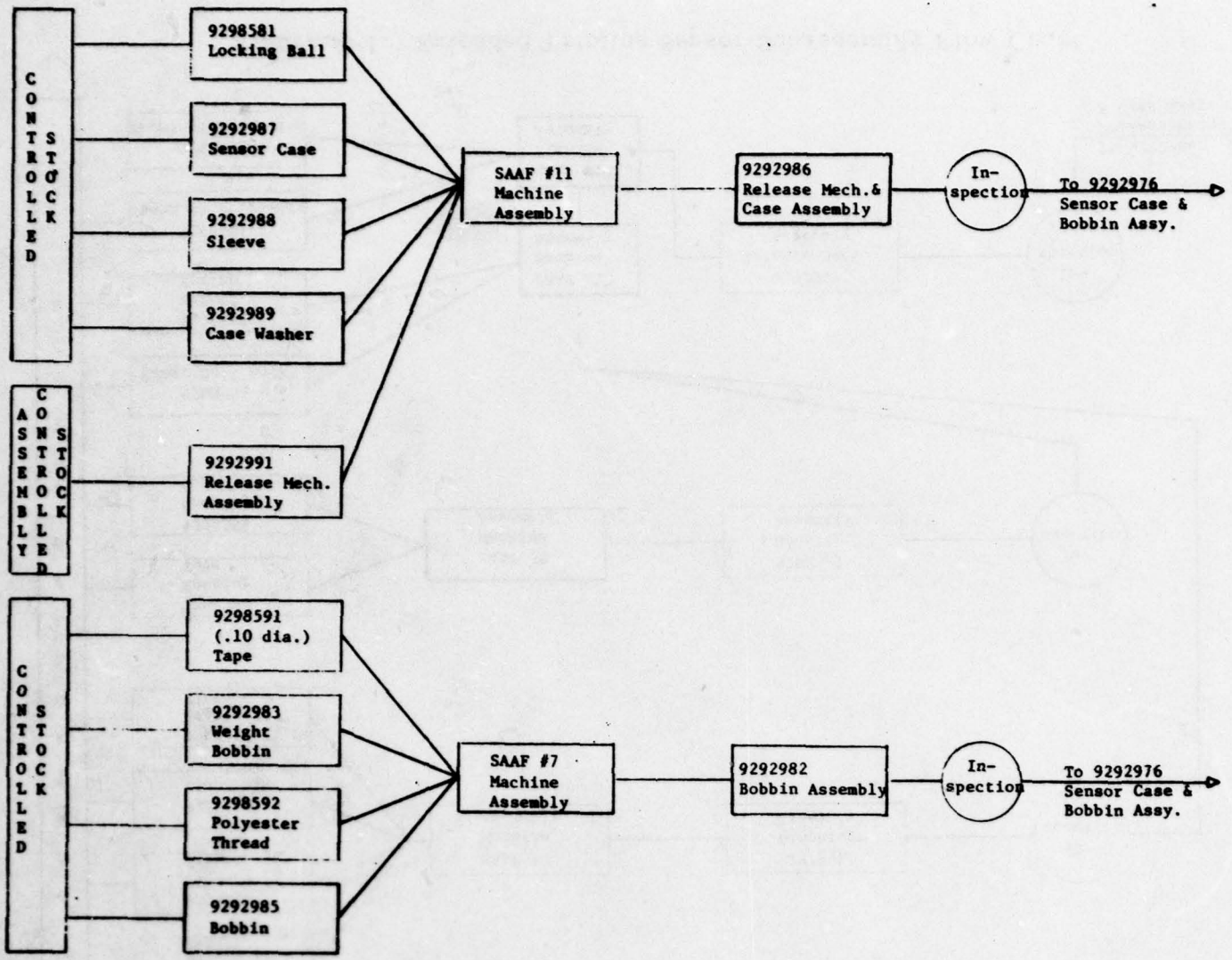


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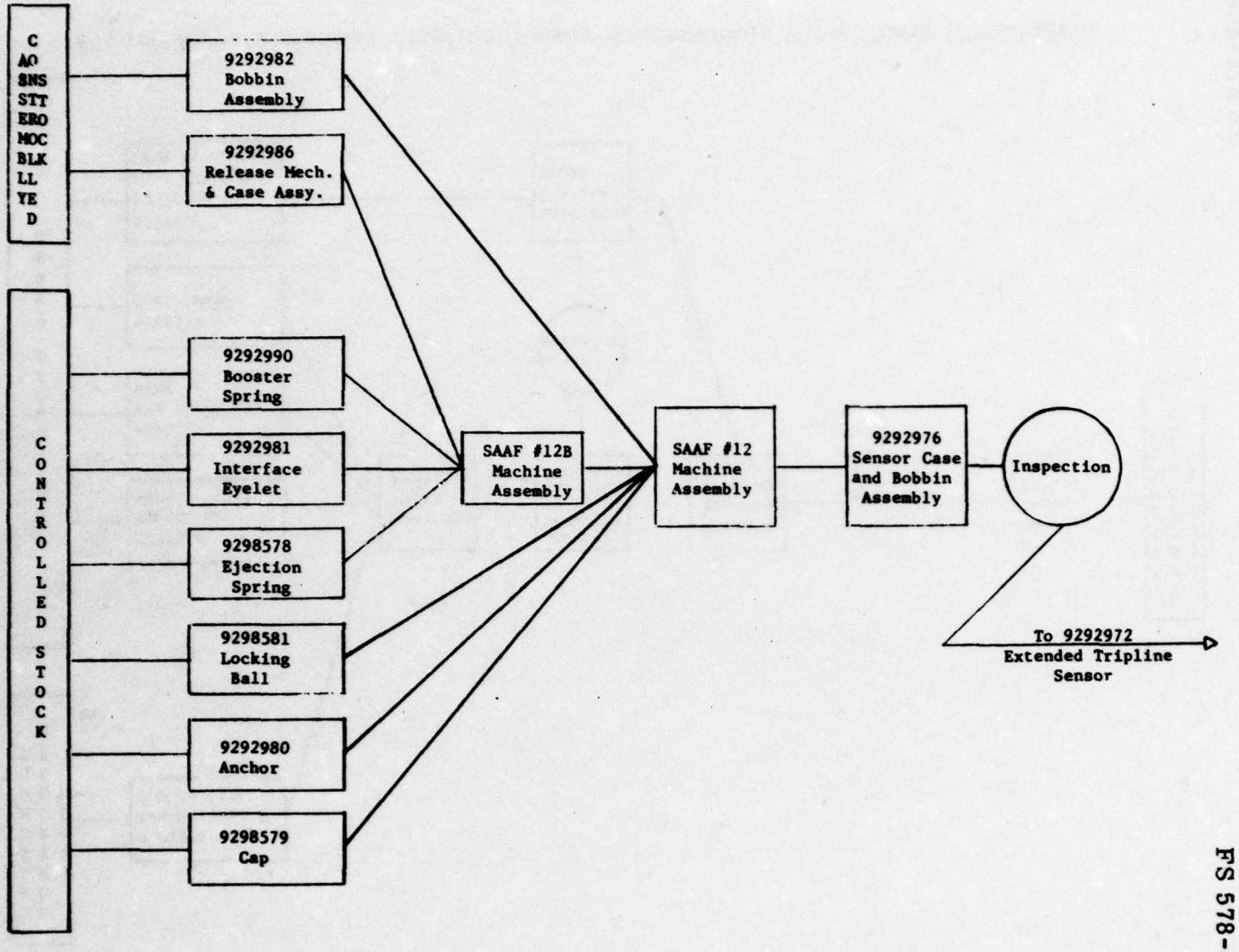
Figure A-1. Extended Tripline Sensor Subassembly Flow Chart (Continued)



FS 578-4869

Figure A-1. Extended Tripline Sensor Subassembly Flow Chart (Continued)

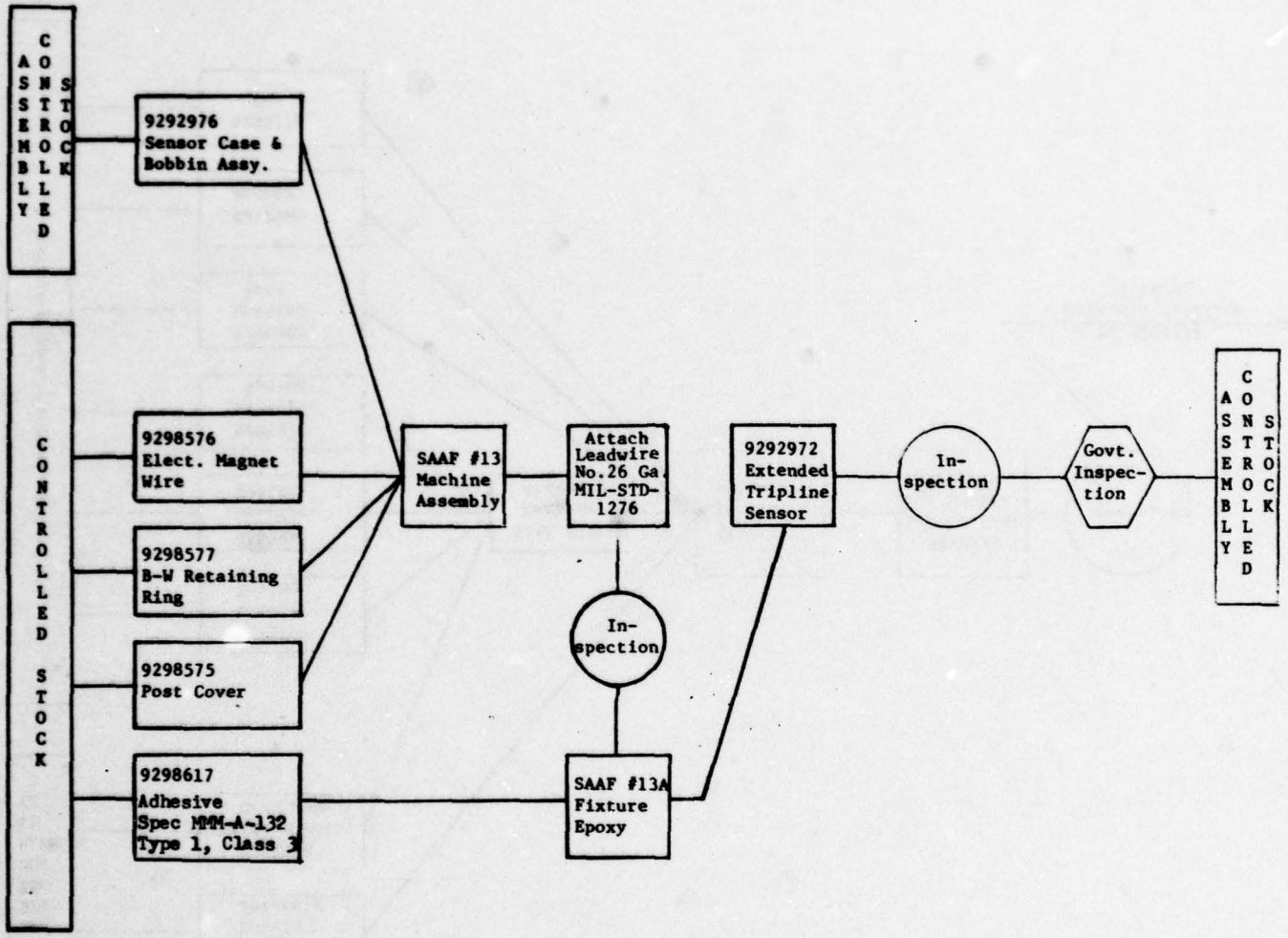


Figure A-1. Extended Tripline Sensor Subassembly Flow Chart (Concluded)

FS 578-4869

At 100,000 total	90,000	sensors/mo.	net
500,000 total	135,000	"	"	"
1,000,000 total	165,000	"	"	"

The line output for various combinations of machines at the three maturity levels is further delineated in Table A-2.

3.1.3 Manufacturing Line Diagram -- Figure A-1 shows the assembly line flow of piece parts and subassemblies through the manufacturing line. Following is a brief description of each assembly machine which includes a discussion of the major functions conducted. The applicable piece part and subassemblies required are listed for each machine.

3.1.4 Interface Definition --

3.1.4.1 Compatibility with Other Lines -- The special automatic assembly line for production of the GEMSS XM74 Tripline Sensor has commonality to varying degrees with the automatic assembly line used to assemble the ADAM Sensor (ref. Table A-1); however, if the GEMSS Sensor Line is self-contained, there would be no interface situation between the two lines. If a GEMSS line were installed without the common machines (i.e., Machine Nos. 8, 9, 10, and 10A) for the Release Mechanism, then there would be an interface between Machine 10A and Machine 11 where the two lines become separate. This provides an option with respect to the number of machines installed which is dependent upon the combined production levels.

3.1.4.2 Facilities/Utilities -- Because of the similarity between the ADAM Line and the GEMSS Line, there will be common usage of certain facilities and utilities. The following facility items would be shared by both assembly lines:

TABLE A-2. NET PRODUCTION PER MONTH AT 100,000, 500,000 AND 1,000,000 LEVELS

	MACHINE NO.	QUANTITIES OF MACHINES						
At 100,000 Total Produced	7	1	2	3	4	5	6	7
	8	1	1	1	2	2	2	3
	9	1	1	1	1	1	2	2
	10	1	1	2	2	3	3	4
	10A	1	1	1	1	2	2	2
	11	1	1	1	2	2	3	3
	12B	1	1	1	2	2	3	3
	12	1	1	2	2	3	4	4
	13	1	1	2	2	3	4	4
	13A	1	1	1	2	2	2	3
	Output (1,000's)	30	60	90	120	150	180	210
At 500,000	7	1	2	3	4	5		
	8	1	1	1	1	2		
	9	1	1	1	1	1		
	10	1	1	1	2	2		
	10A	1	1	1	2	2		
	11	1	1	1	2	2		
	12B	1	1	1	2	2		
	12	1	1	2	2	2		
	13	1	1	2	2	2		
	13A	1	1	2	2	2		
	Output (1,000's)	45	90	135	180	225		
At 1,000,000	7	1	2	3	4			
	8	1	1	1	1			
	9	1	1	1	1			
	10	1	1	1	2			
	10A	1	1	1	2			
	11	1	1	1	2			
	12B	1	1	1	2			
	12	1	1	1	2			
	13	1	1	1	2			
	13A	1	1	2	2			
	Output (1,000's)	55	110	165	220			

- Demagnetizer
  The demagnetizer is used to demagnetize piece parts, tooling and machine components as required.

- Ultrasonic Cleaner-Degreaser
  This equipment is needed for cleaning piece parts, tooling and machine components.

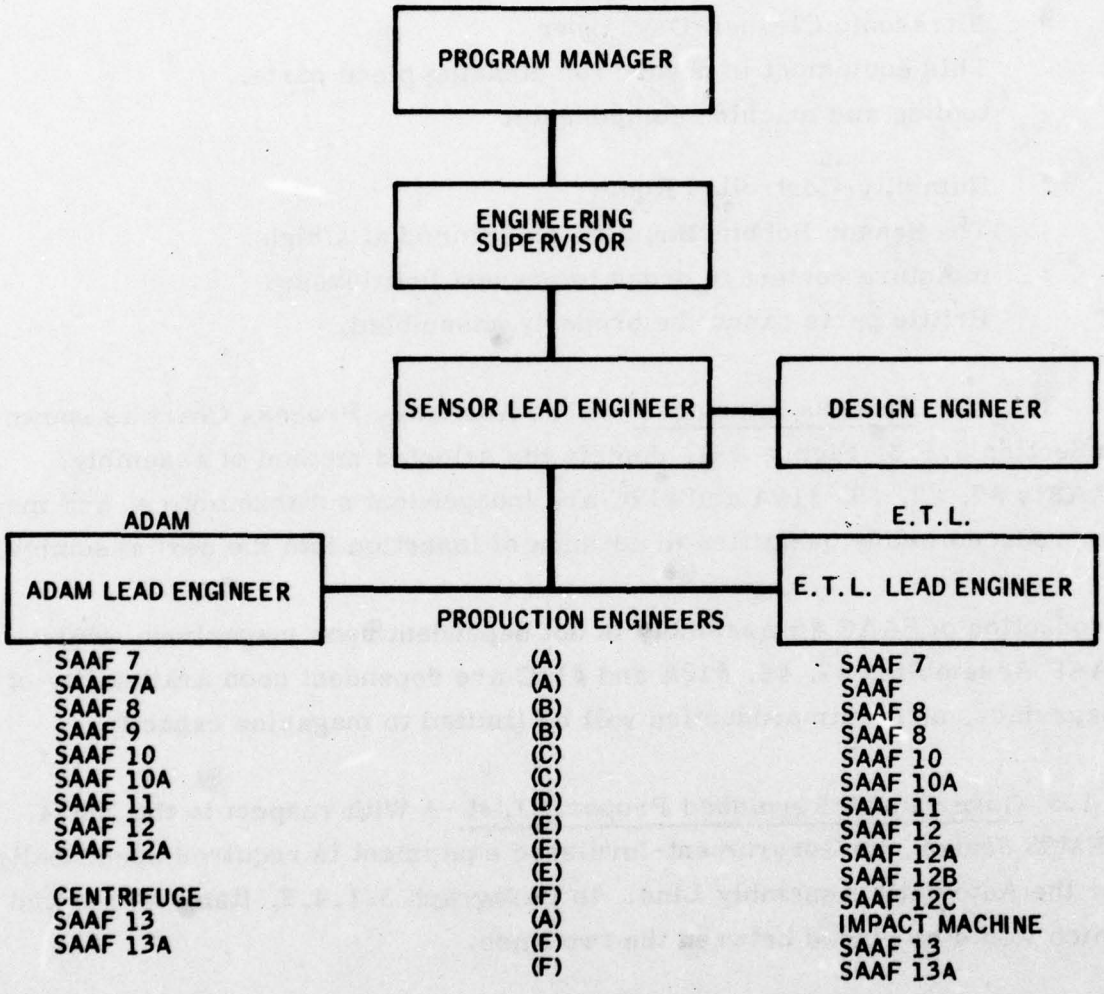
- Humidity-Controlled Room
  The Sensor Bobbins must be maintained at a high moisture content in order to prevent brittleness. Brittle parts cannot be properly assembled.

3.1.4.3 Process Interfaces -- The Assembly Process Chart as shown in Section 3.1.3, Figure A-1, depicts the selected method of assembly. SAAF's #7, #8, #9, #12A and #12C are independent subassemblies, and may be produced in any quantities in advance of insertion into the next assembly.

Production of SAAF #9 Assembly is not dependent upon magazines, while SAAF Assemblies #7, #8, #12A and #12C are dependent upon availability of magazines, and their production will be limited to magazine capacity.

3.1.5 Government-Furnished Property List -- With respect to the XM74 GEMSS Sensor, no Government-furnished equipment is required specifically for the Automatic Assembly Line. In Paragraph 3.1.4.2, items are listed which would be placed between the two lines.

3.1.6 Organizational Concepts -- The close relationship between the GEMSS and ADAM Sensor will result in the assignment of engineering personnel with dual responsibility for similar automatic assembly fixtures.


PROGRAM MANAGER
ENGINEERING SUPERVISOR
SENSOR LEAD ENGINEER
DESIGN ENGINEER
ADAM
ADAM LEAD ENGINEER
E.T.L.
E.T.L. LEAD ENGINEER
PRODUCTION ENGINEERS
SAAF 7
SAAF 7A
SAAF 8
SAAF 9
SAAF 10
SAAF 10A
SAAF 11
SAAF 12
SAAF 12A
CENTRIFUGE
SAAF 13
SAAF 13A
(A)
(A)
(B)
(B)
(C)
(C)
(D)
(E)
(E)
(E)
(F)
(A)
(F)
(F)
SAAF 7
SAAF
SAAF 8
SAAF 8
SAAF 10
SAAF 10A
SAAF 11
SAAF 12
SAAF 12A
SAAF 12B
SAAF 12C
IMPACT MACHINE
SAAF 13
SAAF 13A

3.2 Characteristics

3.2.1 Performance Characteristics -- Special automatic assembly fixtures will produce 750 to 1250 completed assemblies per hour, depending upon the complexity of the assembly.

When the SAAF is double nested, as is the case in GEMSS #9, the output is approximately double the 750 to 1250 assemblies per-hour rate.

The life expectancy of any SAAF is indeterminate. Each component used in the basic machine and the special tooling is replaceable on a modular basis. For example, the contractor has converted WAAPM SAAF's for use on the ADAM Machine Line with acceptable results.

3.2.2 Physical Characteristics --

Production Area:

a. The space required for a typical SAAF is 400 square feet of floor space (20 ft. x 20 ft. square). This area will support parts and assemblies going into the machine, as well as the completed assemblies. The need for aisles and cart storage space is not included in the 400 square feet for the SAAF.

b. The space required for a typical spring winder (there are two on the E.T.L. Sensor), including stress relief ovens (two), would be 625 square feet of floor space. This area would support the carts used to load and store the completed springs, and to deliver the springs to SAAF's 12 and 12B.

c. The space required for an ultrasonic degreaser for cleaning of some parts and especially for cleaning SAAF #11 Nest would be 25 square feet (5 ft. x 5 ft. square).

d. The space required for mixing epoxy for SAAF #13A would be 100 square feet (10 ft. x 10 ft. square). This area would require a special exhaust system to the outside of the building.

e. The space required for sensor lot acceptance testing would be 600 square feet (60 ft. long x 10 ft. wide). This requires a clear area 20 ft. high mid-point in the length of the test area.

f. Allow 10 percent of total for aisles, break area and foreman's office.

Production Area Required:

a.	400 sq. ft. x 10 machines	4000 sq. ft.
b.	Spring winding area	625 sq. ft.
c.	Ultrasonic degreaser	25 sq. ft.
d.	Epoxy mixing area	100 sq. ft.
e.	Sensor LAT area	600 sq. ft.
	Subtotal	5350 sq. ft.
f.	5350 x 10%	535 sq. ft.
	Grand Total	5885 sq. ft.

There are no security requirements with the SAAF or the E.T.L. Sensor with regard to the manufacturing area.

There are two areas where health considerations must be addressed, which are listed in Subparagraph "d" above. The outgassing of the epoxy must be exhausted outside of the work area (building) immediately. The epoxy is

dispensed on Machine 13A, so it must be equated with the exhaust system to remove the outgas from the epoxy.

The E.T.L. SAAF will meet all OSHA requirements prior to their installation on the E.T.L. production floor.

3.2.3 Reliability -- The reliability of each machine in the GEMSS XM74 Extended Sensor production line will have as a design goal a minimum mean-time-between failure (MTBF) of 8.5 hours. A failure is defined as any unscheduled machine stoppage during a scheduled production period which requires repair maintenance personnel action due to breakage or severe misalignment (i.e., malfunction) of any machine subassembly or component. The time the machine runs is the production time associated with machine cycling, but not including any cycling during repairs or other cycling during which good product could not be produced. During the machine performance demonstrations and qualification testing, the number of failures and the production time will be collected as needed to calculate the machine mean-time-between-failure so that reliability growth can be analyzed.

3.2.4 Maintainability -- The maintainability of each machine used in the GEMSS Extended Tripline Sensor production line will have as a design goal a mean-time-to-repair (MTTR) of 1.75 hours. To achieve this goal, the machines will be designed to comply with the following:

a. Modularization - The machines shall be designed to make maximum use of modularized subassemblies for each type of maintenance and to reduce the number and type of repair parts and assemblies required to support maintenance.

b. Accessibility - Maximum use will be made of design techniques that will provide ready accessibility for replacement or servicing.

c. Interchangeability - Components will be interchangeable without requirements to calibrate or adjust at time of replacement.

d. Maintenance Periods - The system will be designed so that preventive maintenance is required only in off-production hours.

All machines are analyzed for MTTR using the definition of failure presented in Paragraph 3.2.3. The repair time will include preparation time, fault location time, fault correction time, adjustment/calibration time and checkout time. If two or more repair personnel are involved, only elapsed time will be measured. However, the number, skills, and elapsed time for each repair person shall be recorded. During the machine performance demonstrations and qualification testing, the number, type of failure, and the time to repair will be collected so that machine maintainability characteristics can be analyzed.

3.2.5 Availability -- The machines used in the GEMSS XM74 Extended Tripline Sensor production line shall be designed to minimize the downtime (MTTR) and to maximize the uptime (MTBF) for each machine. The machines shall be designed to have a minimum inherent availability of 85 percent. The inherent availability is defined as:

$$\text{Availability} = \frac{\text{MTBF}}{\text{MTBF} + \text{MTTR}} \times 100\%$$

Where MTBF = Mean Time Between Failures
MTTR = Mean Time to Repair

3.2.6 Environmental Conditions -- The toxic nature of the outgassing from the epoxy mixture is the only known natural environmental item. The experience gained from the ADAM Sensor is that when the outgassing is exhausted to the outside air, there is no problem, as the epoxy gasses are quickly dispelled.

3.3 Design and Construction

3.3.1 Name Plates and Marking -- There is no general criteria used for identification and markings on electrical and pneumatic lines and controls. Identification here is only used when necessary. Lines are identified whenever hydraulic or water lines are concerned to avoid confusion in the machine system.

3.3.2 Interchangeability -- Standardized tooling and castings have been utilized in the design and assembly of assembly machines. Some of the standardized features include: probes, parts feeding mechanisms, magazine feeders, work stations, etc. This major emphasis on standardization throughout reduces the number and type of repair parts required to support maintenance and maintain interchangeability to a maximum.

3.3.3 Safety -- Through the use of good design and the proper selection of material, machine safety shall be in conformance with the intent, and general interpretation of the following safety publications and codes:

a. AMCR385-100, AMC Safety Manual

b. AR40-5, Health and Environment

c. MIL-STD-882A, System Safety Program Requirements

d. Occupational Safety and Health Act (OSHA)

e. National Electric Code for Hazardous Operations

The Safety Engineering effort will be coordinated with RAM and HFE efforts to establish an integrated program. A safety review of each machine shall be conducted to determine compliance with the above-listed publications.

3.3.4 Human Performance/Human Engineering -- Each machine in the GEMSS XM74 Extended Tripline Sensor production line shall be in conformance with the intent and general interpretation of the following documents:

a. MIL-STD-1472B Human Engineering Design Criteria for Military Systems Equipment and Facilities

b. MIL-HDBK-759 Military Standardization Handbook, Human Factors Engineering Design for Army Material

A human factors review of each machine shall be conducted prior to release of the machine for use in the normal production environment to determine compliance with the above-listed documents.

3.4 Process/Operation Characteristics/Configuration Items

3.4.1 Flow Diagram -- The process/operation flow diagram is included in Section 3.1.3, Figure A-1.

3.4.2 Function and Physical Interfaces --

Physical Interface Between SAAF --

From SAAF	to SAAF	Physical Interface of Parts and Assembly Between SAAF is by
8	10	By magazines
9	10	Bulk - into #10 by feed bowl
10	10A	By magazines
10A	11	By magazine
11	12B	By magazine
12C	12B	By spring magazine
12A	12B	By spring magazine
12B	12	By magazine
12	13	By magazine
13	13A	By magazine
7	12	Off #7 to container, then hand loaded into magazines

Functional Interfaces Between SAAF -- The operation accomplished on SAAF #12B has a functional interface between SAAF's 12B and 12. The ejection spring and the booster spring are compressed and a retaining pin is inserted into the assembly on SAAF 12B. The retaining pin is removed on SAAF 12.

This is the only functional interface in the GEMSS Sensor Automatic Assembly Line.

3.4.3 Functional and Flow Diagrams -- Functional diagrams (dial layouts) are included with the description of each of the assembly machines. Line flow diagram (Figure A-1) is included as part of Section 3.1.

MACHINE #7
BOBBIN ASSEMBLY, 9292982

PARTS

- Bobbin, 9292985
- Thread, 9298592
- Tape, 9298591
- Weight Bobbin, 9292983

Bobbin has two parts:

Core, which thread is wound around, and post which fits into the Release Mechanism Assembly.

PURPOSE OF ASSEMBLY

To store thread, approximately 46 feet, which is wound about the Bobbin Core in a manner that it will easily deploy from the Bobbin when the Sensor Assembly is functioned.

The tape is used only to maintain one end of thread in proper position.

The weight is used to trap the other end of the thread, which will maintain a pull force consistent with the requirement of the drawing; see Figure A-2 and A-3.

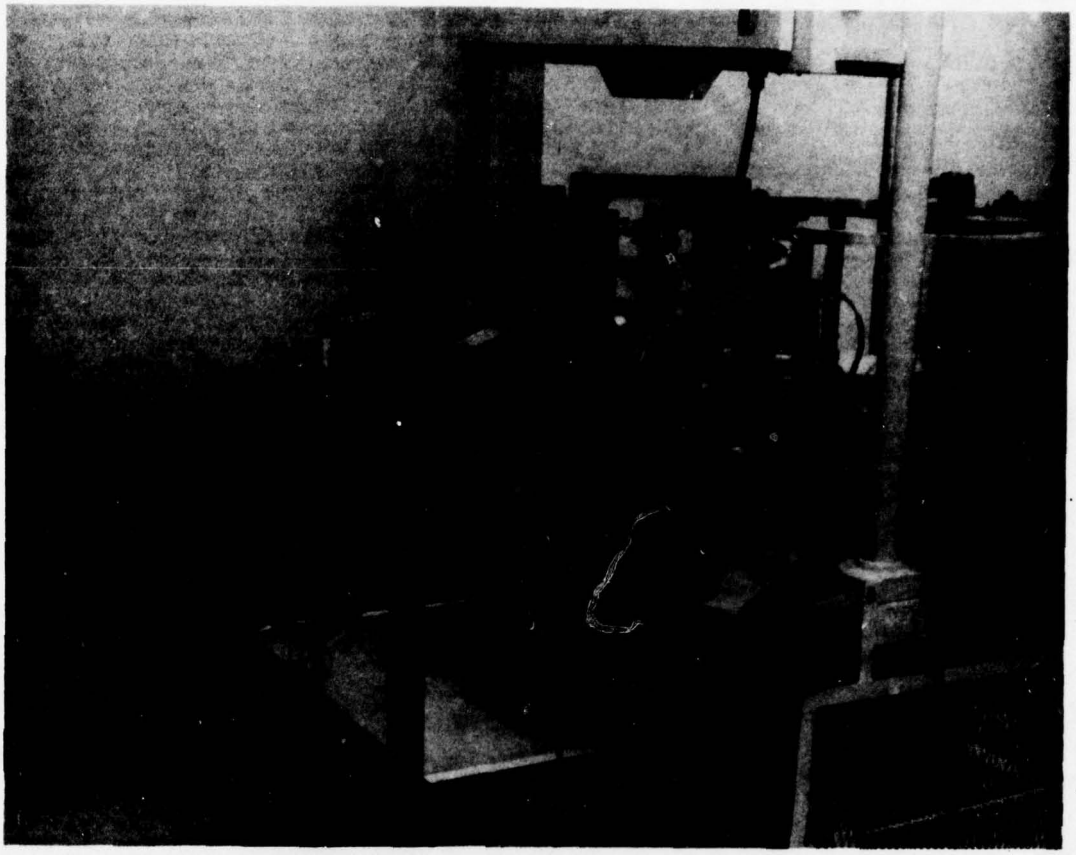


Figure A-2. WAAPM-Type Semiautomatic Bobbin Winding and Taping Machine

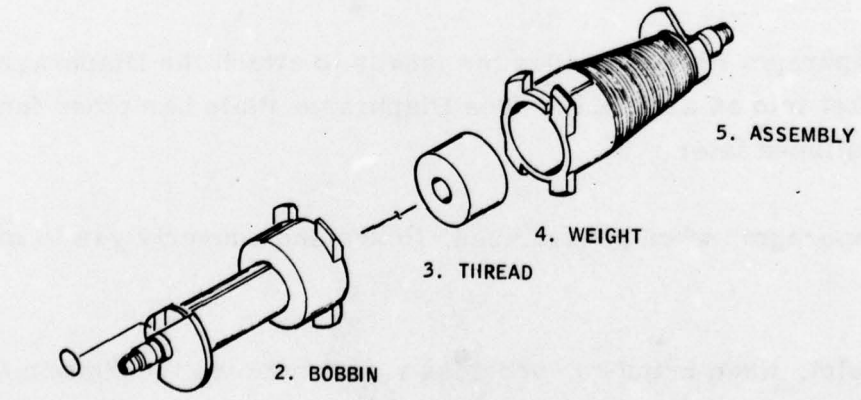


Figure A-3. XM74 Bobbin Assembly

MACHINE #8
DIAPHRAGM ASSEMBLY, 9292998

PARTS

- Diaphragm, 9298598
- Diaphragm Plate, 9298597
- Eyelet, Diaphragm, 9298599
- Gasket, Fibrous, 9298618

PURPOSE OF ASSEMBLY

The Diaphragm Assembly, Figure A-4, is used to convert gas pressure, which is delivered to the Diaphragm, into uniform mechanical motion, which results in sensor release.

The Diaphragm Plate provides the means to attach the Diaphragm Eyelet and the gasket into an assembly. The Diaphragm Plate has other functions, which are mentioned later.

The Diaphragm, when pressurized, flexes and converts gas to mechanical motion.

The Eyelet, when crimped, provides a seal between the Plate and Diaphragm.

The Gasket, Fibrous, provides a controlled leak path for the gas pressure to leak off after the sensor has been released.

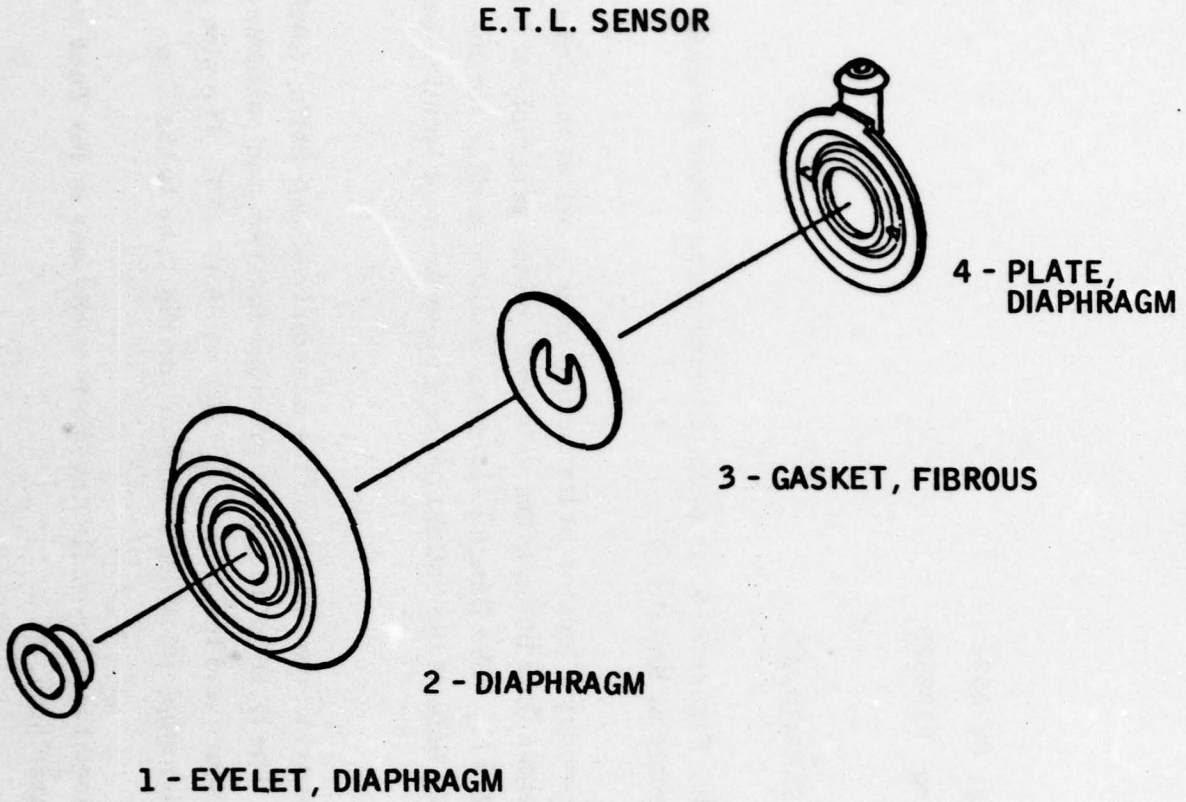


Figure A-4. Machine No. 8 - Diaphragm Assembly

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MACHINE #9
HOUSING ASSEMBLY, 9298587

PARTS

- Cup, Housing, 9298588
- Tube, Housing, 9298589

PURPOSE OF THE ASSEMBLY

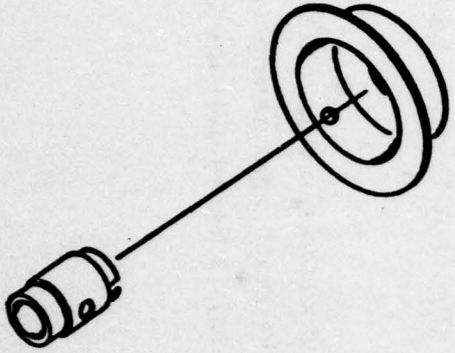
The Housing Assembly, Figure A-5, is used to house parts of the Release Mechanism, the assembly at SAAF #10.

The Cup, Housing, provides a locator in its center hole to orient the Tube, Housing. It also provides four holes in its side wall for the assembly of four Locking Balls at SAAF #11. The flange provides a sealing surface for the Diaphragm. The small hole at the bottom of the Cup is for nest location purposes only.

The Tube, Housing, provides two holes for the assembly of two Balls, Locking, at Machine #12. The O.D. of the Tube provides location and concentricity for the two Spring Washers and the Ring Ball Lock at SAAF #10. The slot in the end of the Tube, Housing, provides a locator for the Tube to the Cup.

The assembly is crimped together by flaring the two sections of the Tube over the Cup, Housing, center hole.

E.T.L. SENSOR



2 - CUP, HOUSING

1 - TUBE, HOUSING

Figure A-5. Machine No. 9 - Housing Assembly

MACHINE #10
RELEASE MECHANISM ASSEMBLY, 9292991

PARTS

- Housing Assembly, 9298587
- Diaphragm Assembly, 9292998
  - Spring Washer (2), 9298582
  - Ring, Ball Lock, 9298586

PURPOSE OF THE ASSEMBLY

The Release Mechanism Assembly, Figure A-6, is the heart of the sensor release function.

The two Spring Washers are oriented and assembled into the Housing Assembly, followed by the Ring, Ball Lock. The Diaphragm Assembly is placed on the assembly, and then the Tube, Housing, is flared over the Diaphragm Eyelet, completing the assembly.

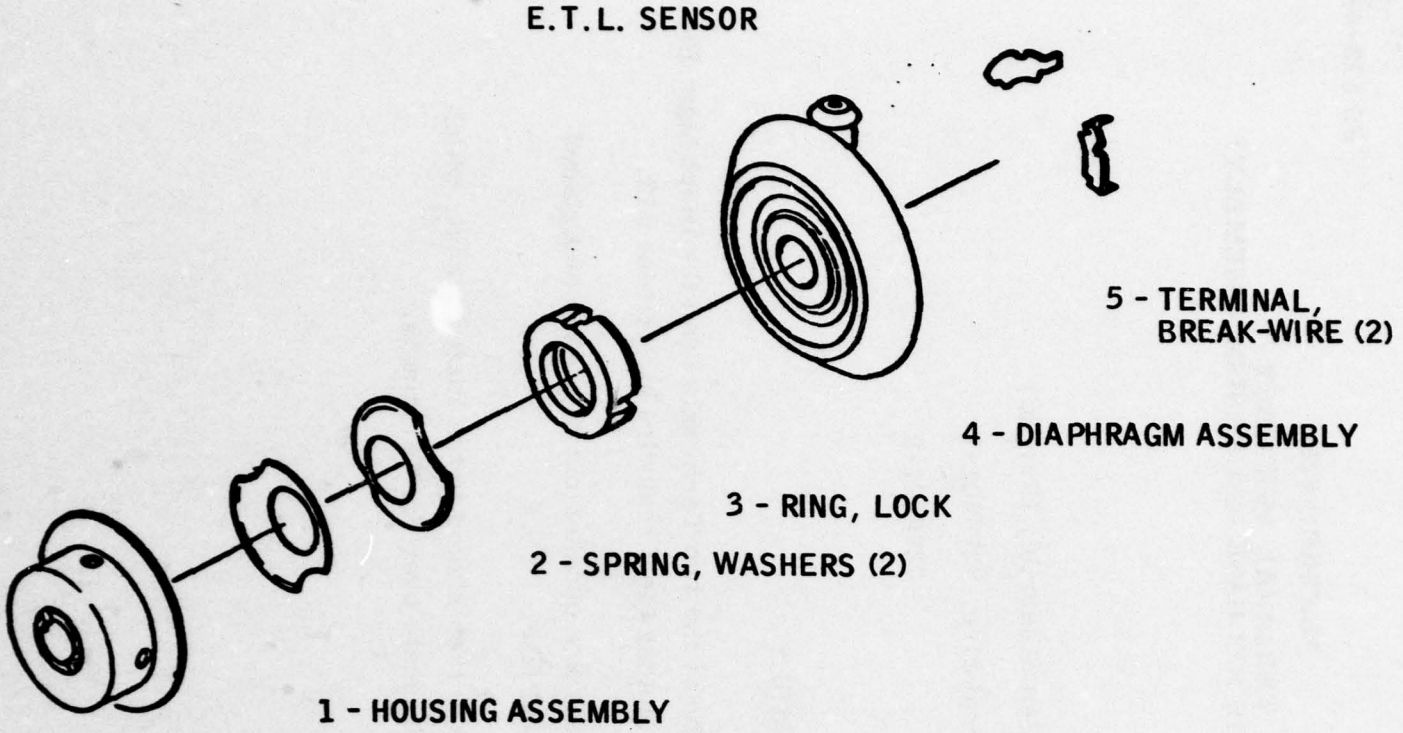


Figure A-6. Machine No. 10A - Release Mechanism Assembly

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MACHINE #10A

TERMINAL ASSEMBLY
(PART OF THE RELEASE MECHANISM ASSEMBLY)

PARTS

- Release Mechanism Assembly (Partial)
  - Terminal, Breakwire, 9298601-1
    9298601-2

PURPOSE OF THE ASSEMBLY

The placement and location of the two Terminals upon the Diaphragm Plate is to provide a method to solder the Breakwire at Machine #13.

- The two Terminals are punched out of a strip and placed on the Diaphragm Plate.
- The Terminals are then staked to the Plate by heat, which stakes two plastic posts over the Terminals.

MACHINE #11
RELEASE MECHANISM AND CASE ASSEMBLY, 9292986

PARTS

- Release Mechanism Assembly, 9292991 (Figures A-7 and A-8)
  - Sleeve, 9292988
  - Case, Sensor, 9292987
  - Case, Washer, 9292989
  - Ball, Locking (4), 9298581

PURPOSE OF THE ASSEMBLY

The four Balls are assembled into the four holes of the Sleeve and the Cup, Housing. The crimp of the Sensor Case completes the assembly.

- The four holes in the Sleeve provide the means to contain the four Locking Balls.
- The Case, Sensor, provides the envelope protection for the Sensor, and the case crimp contains all parts in the proper position.
- The Case, Washer, locates the Release Mechanism Assembly in the Sensor Case and captivates the four Locking Balls in the proper position.
- The four Locking Balls retain the Sleeve between the O.D. of the Cup, Housing, and the O.D. of the Case, Washer.

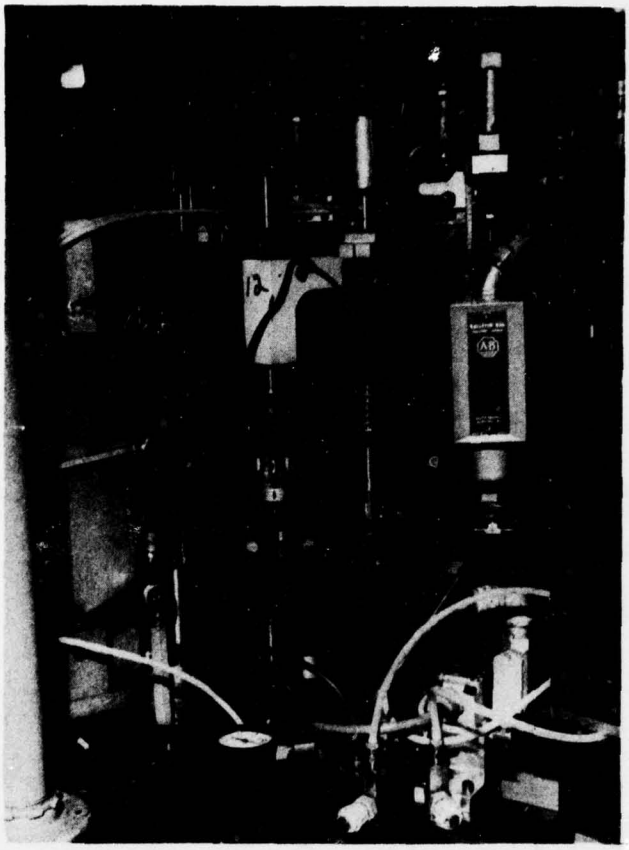


Figure A-7. ADAM Release Mechanism and Case Assembly Machine

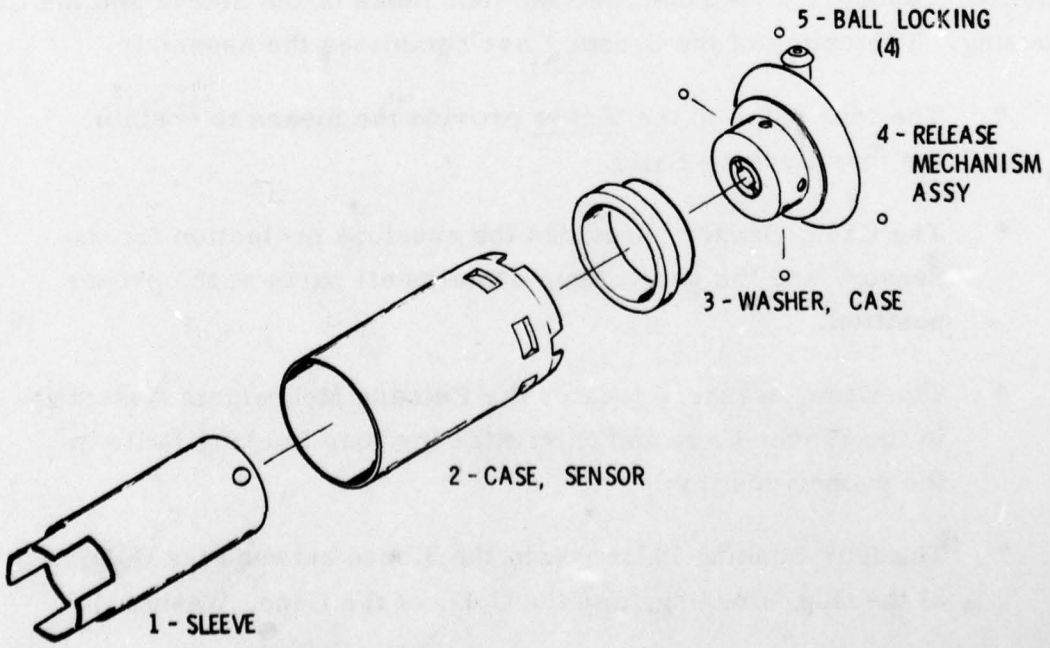


Figure A-8. XM74 Release Mechanism and Case Assembly

MACHINE #12
SENSOR CASE AND BOBBIN ASSEMBLY, 9292976 (COMPLETE)

PARTS

- Sensor Case and Spring Assembly (from SAAF 12B)
  - Bobbin Assembly, 9292982
  - Ball, Locking (2), 9298581
  - Cap, 9298579
  - Anchor, 9292980

PURPOSE OF THE ASSEMBLY

The two Balls are assembled into the two holes of the Tube, Housing (Machine #9).

The Bobbin Assembly, Figures A-9 and A-10, is assembled into the Tube Housing (Machine #9) and at the same time into the Sleeve.

- The Balls (2) provide the Release Mechanism the capability to lock up the Bobbin Post while the thread of the Bobbin Assembly is being deployed.
- The Anchor is bowl fed and compressed to fit into the I.D. of the Sensor Case.
- The Cap is a part which adds weight to the Bobbin Assembly for better deployment. It also captivates the Bobbin within the legs of the Sleeve, and the four tabs of the Cap lock over

the four "legs" of the Sleeve, so the assembly will survive the launch environment.

- The Bobbin Assembly is partially drilled on this machine to reduce drilling "heat" on Machine #13.

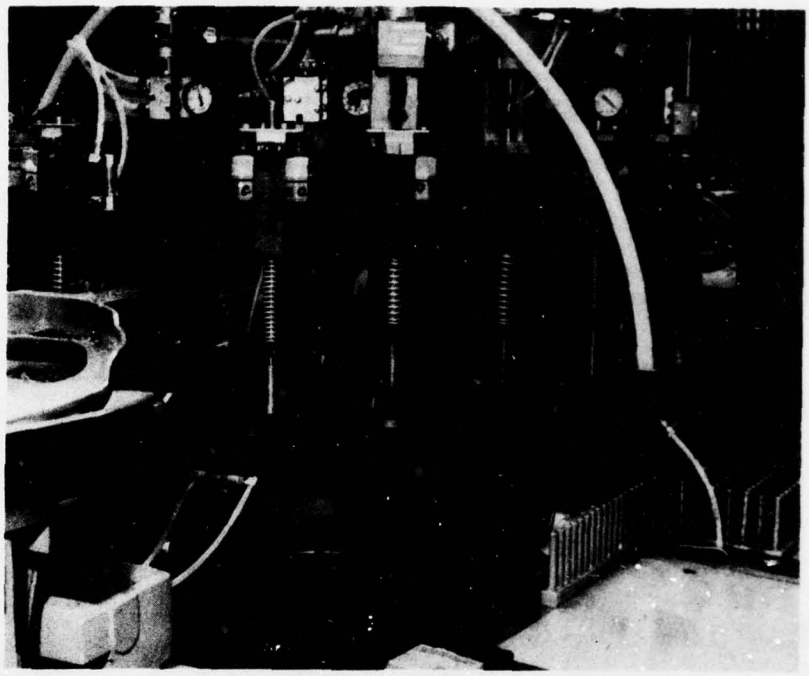


Figure A-9. ADAM Sensor Case and Bobbin Assembly Machine

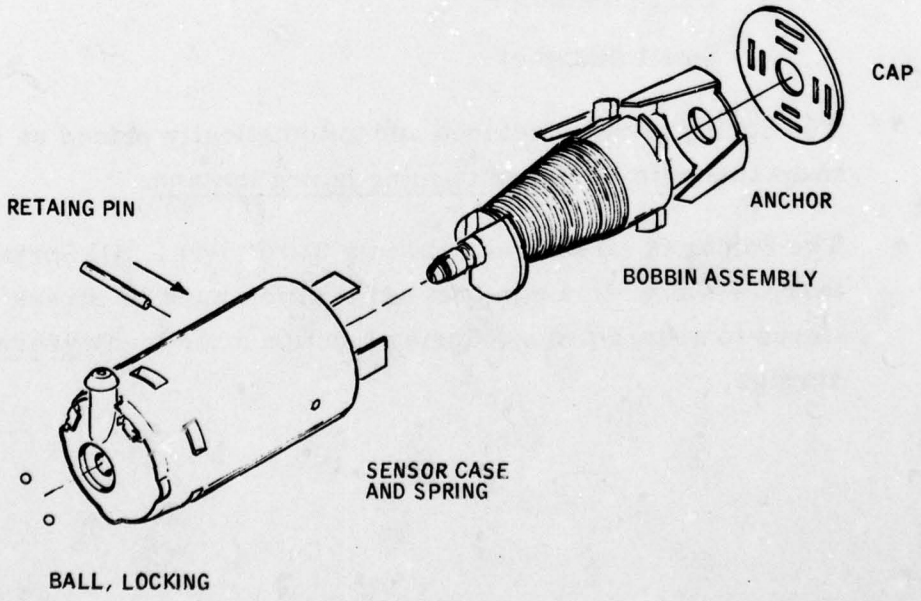


Figure A-10. XM74 Sensor Case and Bobbin Assembly

MACHINE #12A
SPRING, EJECTION, 9298578

PARTS

None

PURPOSE OF THE SPRING

The Spring provides the power and weight to deploy the thread past the minimum deployment requirement.

- The Spring has two diameters:
  a. Large diameter
  b. Small diameter
- The Spring is manufactured and automatically placed on a magazine with the large opening facing upward.
- The Spring is stress relieved in a 350°F oven. All Springs that are stored in a compressed position must be stress relieved to assure proper Spring function after many years of storage.

MACHINE #12B
SENSOR CASE AND SPRING ASSEMBLY, 9292976 (PARTIAL)

PARTS

- Release Mechanism and Case Assembly, 9292986 (Figure A-11)
  - Spring, Booster, 9292990
  - Eyelet, Interface, 9292981
  - Spring, Ejection, 9298578

PURPOSE OF THE ASSEMBLY

The Booster Spring and the Ejection Spring provide the power to deploy the thread past the minimum deployment requirement.

The large I.D. of the Booster Spring will lock onto the diameter provided on the Case, Washer.

The small I.D. of the Ejection Spring will lock onto the outside diameter of the Sleeve.

The Eyelet, Interface, separates the Booster Spring from the Ejection Spring. When the thread deploys, it will be contained within the I.D. of the Eyelet.

The Springs (2) will be compressed and remain in the compressed condition until SAAF #12, where a retaining pin will be removed for assembly of the two Locking Balls, Bobbin Assembly, Anchor and the Cap.

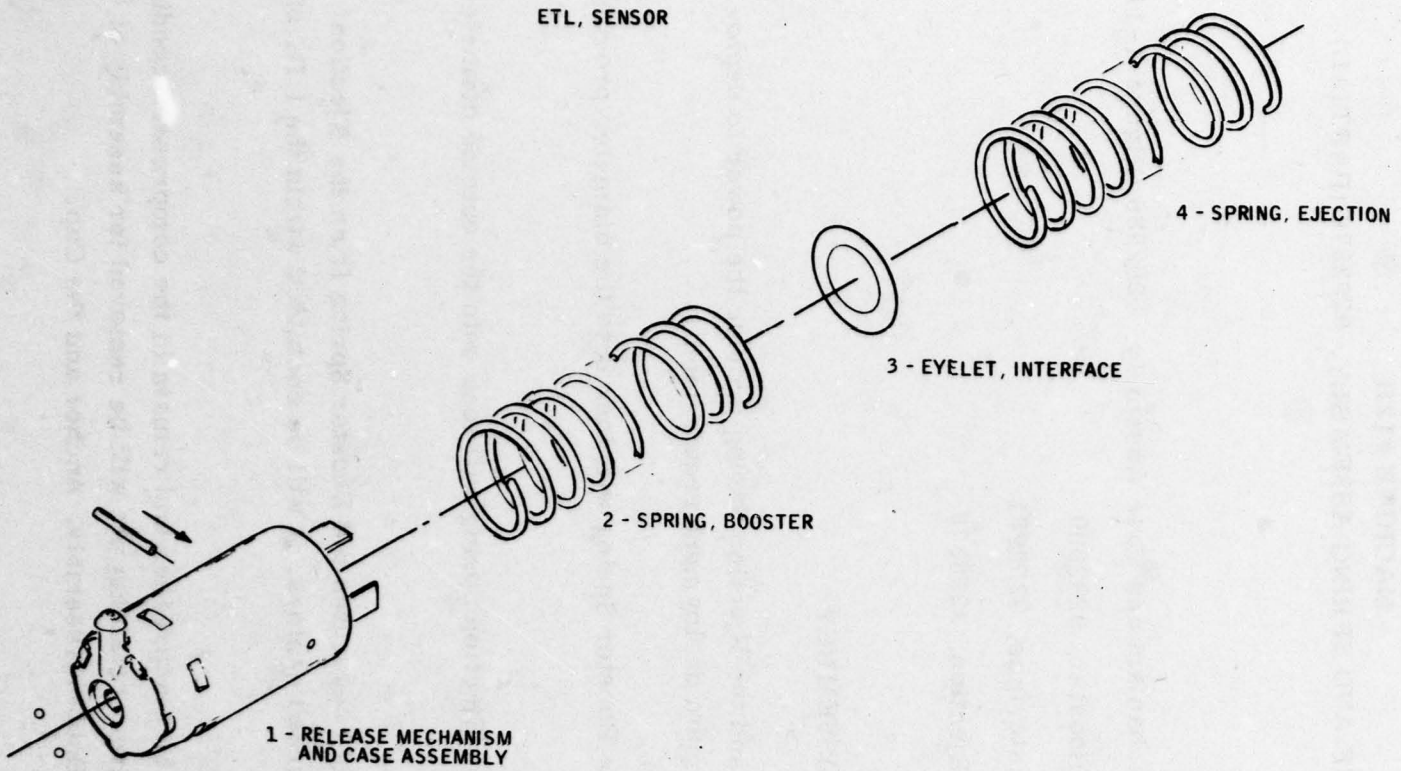


Figure A-11. Machine #12B - Sensor Case and Spring Assembly

MACHINE #12C
SPRING, BOOSTER, 9292990

PARTS

None

PURPOSE OF THE SPRING

The Spring provides the power and weight to deploy the thread past the minimum deployment requirement.

- The Spring has two diameters:
  a. Large diameter
  b. Small diameter
- The Spring is manufactured and automatically placed on a magazine with the large opening facing upward.
- The Spring is stress relieved in a 350°F oven. All Springs that are stored in a compressed position must be stress relieved to assure proper Spring function after many years of storage.

MACHINE #13
SENSOR ASSEMBLY, 9292972

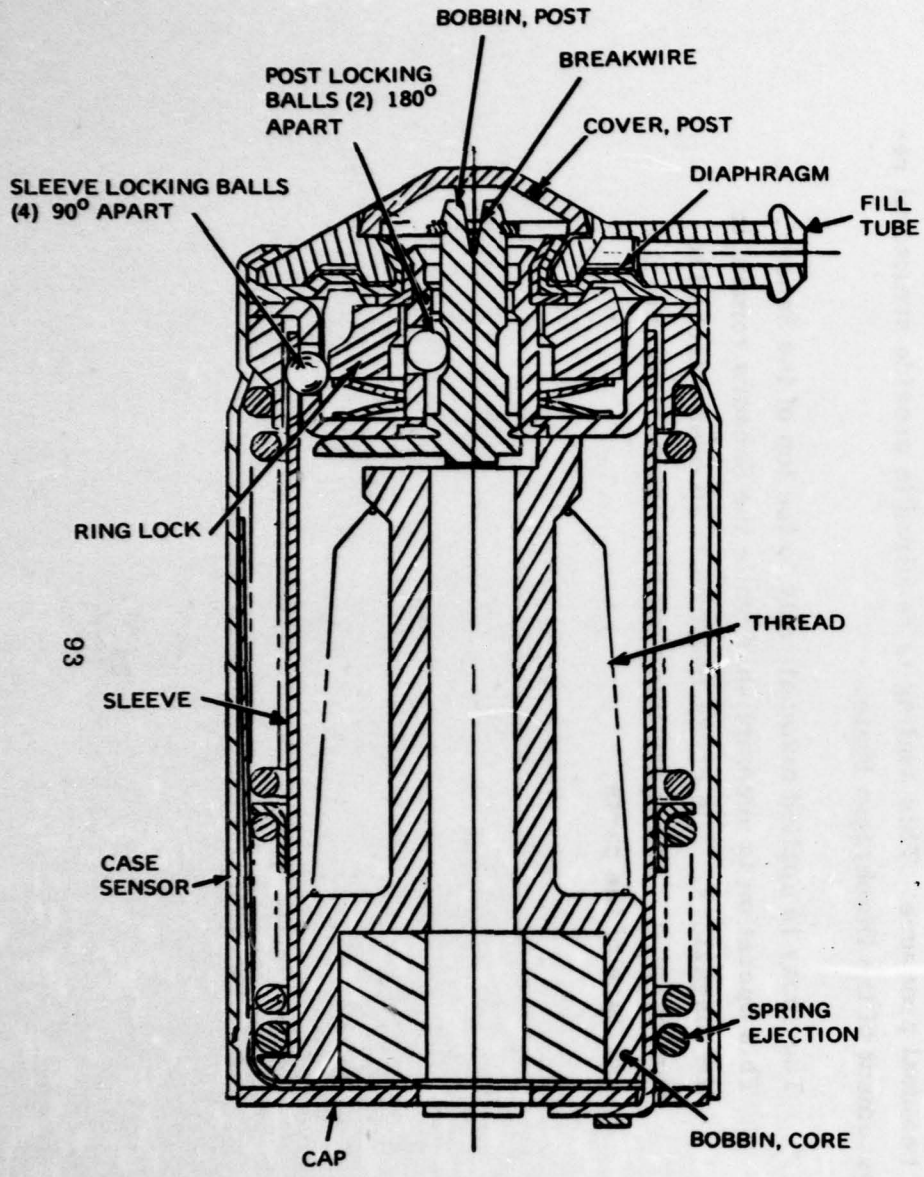
PARTS

- Sensor Case and Bobbin Assembly, 9292976 (Figure A-12)
  - Breakwire, 9292576
  - Ring, Retaining, 9298577
  - Cover, Post, 9298575

PURPOSE OF THE ASSEMBLY

The Breakwire is placed into the 'V' of the Bobbin Post. The Retaining Ring is placed into the radial groove of the Bobbin, the Post Cover is assembled, and at the same time, the Breakwire is pulled taut. The Breakwire is soldered to the Terminals (2) (Machine #10A).

- The Breakwire (.004 insulated copper wire) is broken when the Bobbin thread pulls on the Bobbin Post. The electronics of the device detects the change in the circuitry which causes the mine to detonate.
- The Retaining Ring captivates the Breakwire in the 'V' slot of the Bobbin. Its large diameter will not permit the Bobbin Post to leave the Tube, Housing.
- The Post Cover seals the opening above the Bobbin Post. The Cover fits into the cavity of the Diaphragm Plate. The Post Cover, when seated, will pull the Breakwire taut, which gives uniformity to Breakwire function.



SEQUENCE OF EVENTS TO FUNCTION SENSOR

1. Gas pressure enters diaphragm plate through port in fill tube.
2. Pressure moves diaphragm downwards moving ring lock, which in turn flattens (2) spring washers (Belville shaped springs).
3. As the ring lock is moving it cams the two post locking balls inwards, holding the post of the bobbin assembly.
4. The ejection spring and booster spring then pushes sleeve, cap anchor and bobbin core and thread free of the sensor case, and deploys approximately 40 feet of tripline.
5. The post locking balls will hold the post firmly until the pressure leaks off and the spring washers will push the ring lock to its original at rest position, releasing the post which is then free to move and is attached to the .004 breakwire.

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Figure A-12. Sensor Case and Bobbin Assembly

MACHINE #13A
EPOXY APPLICATION TO THE SENSOR ASSEMBLY

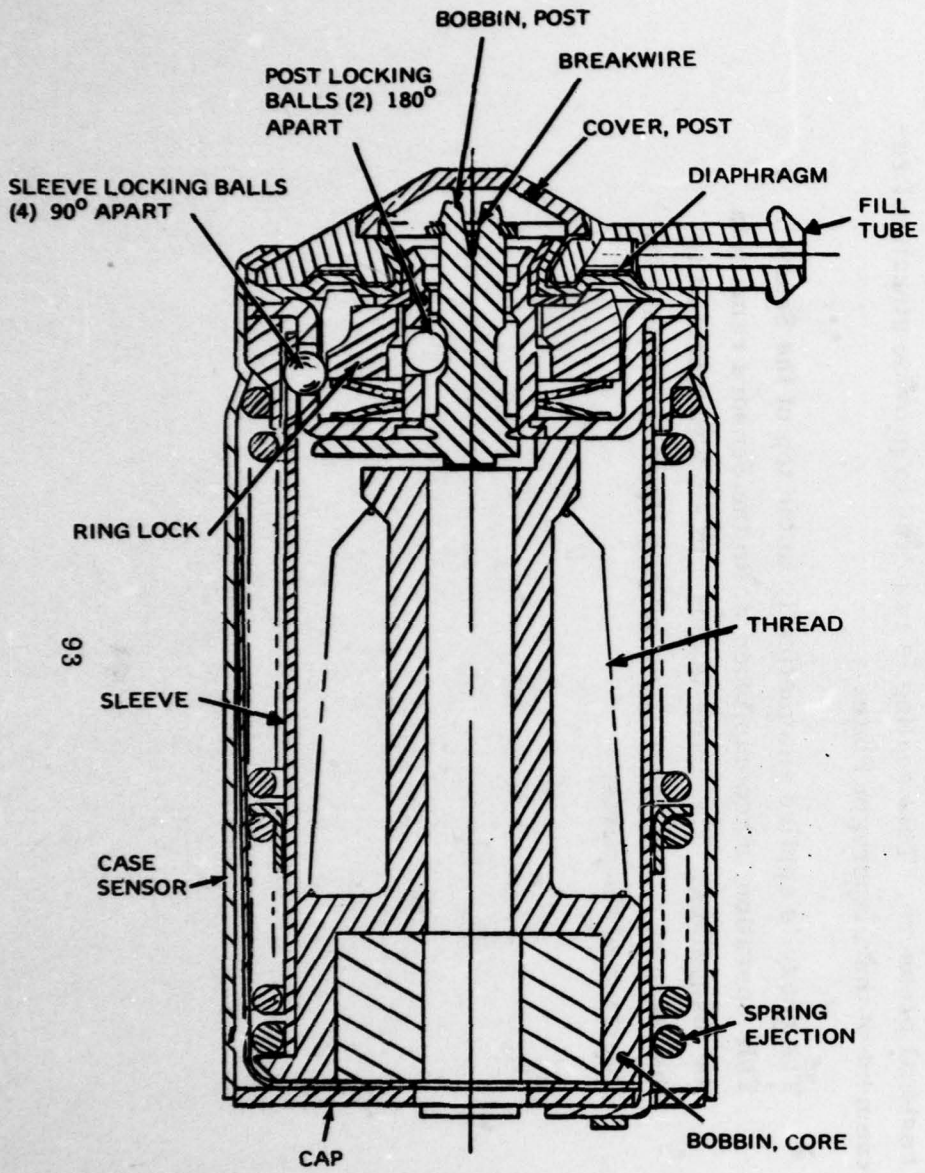
PARTS

Epoxy

PURPOSE OF THE ASSEMBLY

The application of epoxy to the top of the Sensor Assembly is to seal the interface between the Post, Cover, and the Diaphragm Plate (Figure A-13 and A-14). In addition to sealing the interface between the Diaphragm and the Diaphragm Plage 360°, the epoxy is applied and the cure of the epoxy is effected without any residual pressure. This sealing is required to provide structural reinforcement of the Diaphragm Plate.

- The epoxy is applied automatically to the top of the Sensor. This operation is accomplished while the Sensors remain in the magazines. The epoxy is cured in an oven attached to the machine. The epoxy thins out and flows freely into the interface of the parts.



SEQUENCE OF EVENTS TO FUNCTION SENSOR

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4. The ejection spring and booster spring then pushes sleeve, cap anchor and bobbin core and thread free of the sensor case, and deploys approximately 40 feet of tripline.
5. The post locking balls will hold the post firmly until the pressure leaks off and the spring washers will push the ring lock to its original at rest position, releasing the post which is then free to move and is attached to the .004 breakwire.

Figure A-12. Sensor Case and Bobbin Assembly

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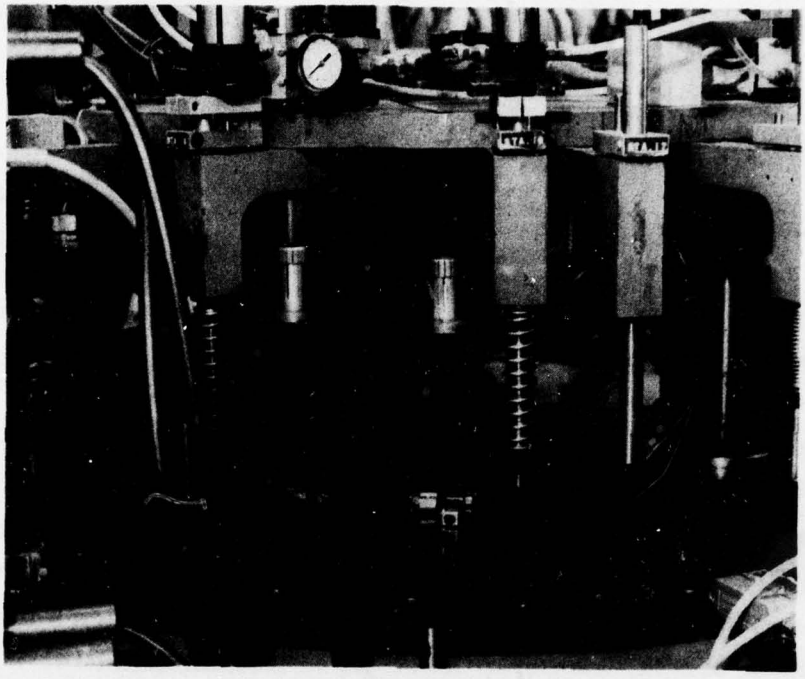


Figure A-13. ADAM Sensor Assembly Machine

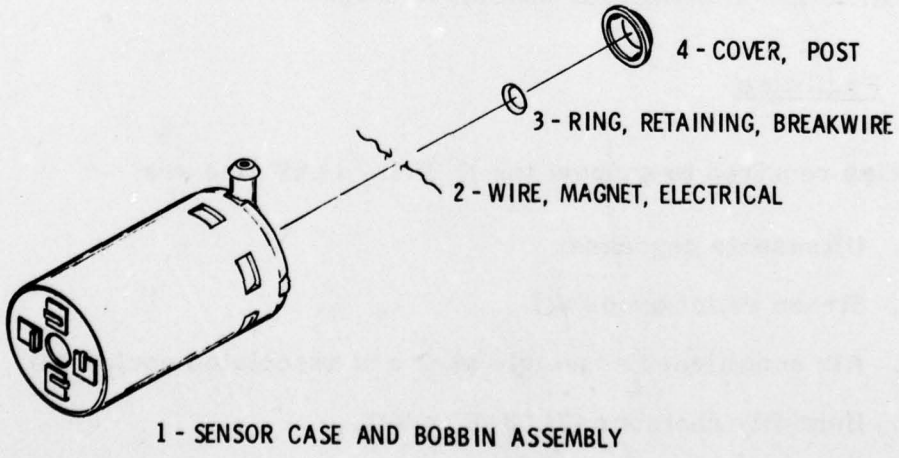


Figure A-14. XM74 Sensor Assembly Machine

3.5 LOGISTICS

3.5.1 Support

Critical components for repair or replacement are stocked using a "Min/Max" Tooling System.

The responsible engineer assigned to a SAAF establishes a Min/Max Tooling List for all critical pieces of special tooling which are subject to wear or being damaged. He then orders the maximum quantity to be held in the Tool Handling Crib. As the tooling is used and the minimum quantity is then on hand, the crib attendant notifies the engineer, who places an order for replacement of special tooling to meet the maximum quantity.

The engineering crew establishes min/max quantities on OML parts which are common among all the SAAF's. The reorder of these components is identical to the min/max for special tooling.

3.5.2 Facilities

Facilities required to support the E.T.L. SAAF line are:

1. Ultrasonic degreaser
2. Stress relief ovens (2)
3. Air conditioned assembly area and associated equipment
4. Humidity chamber (2), 8 ft. x 8 ft.
5. Demagnetizer
6. Epoxy mixing equipment

Description of facilities required:

1. Ultrasonic degreaser

   Baron Blakeslee MRS-120
   460V 1 Ø 60-cycle

2. Stress relief ovens (2)

   Dispatch oven V 35 HP
   440V 3 Ø 60-cycle

3. Air conditioned assembly area and associated equipment

   No preference

4. Humidity chambers (2)

   Chamber by contractor
   Humidity equipment - no preference

5. Demagnetizer

   Electromatic - LAC - 15 VB
   Belt feeding
   460V AC 1 Ø 50-60 cycle

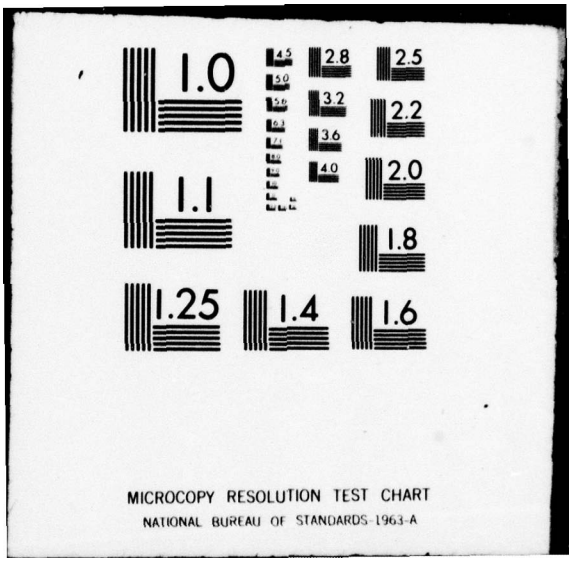
6. Epoxy mixing equipment

3.5.3 Utility Consumption

SAAF No.	Electric Power	Compressed Air	Fuel Oil	Gas	Water	Steam
7	2.29	950	-	-	-	-
8	2.29	950	-	-	-	-
9	2.29	950	-	-	-	-
10	2.44	950	-	-	-	-
10A	2.44	950	-	-	-	-
11	2.51	950	-	-	-	-
12	2.67	950	-	-	-	-
12A	.42	950	-	-	-	-
12B	2.67	950	-	-	-	-
12C	.42	950	-	-	-	-
13	13.72	950	-	-	-	-
13A	2.44	950	-	-	-	-
TOTAL	36.60	11,400				
UNIT	KWH/M	CFH/M				

AD-A063 424 HONEYWELL INC HOPKINS MN DEFENSE SYSTEMS DIV F/G 19/1
PRODUCIBILITY ENGINEERING AND PLANNING (PEP) OF THE XM74 GEMSS --ETC(U)
AUG 78 R FAIRCHILD DAAK10-77-C-0047
UNCLASSIFIED 47419 NL

2 OF 3
AD
A063424


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

The data listed above is from a 1977 utility usage analysis (Figure A-15) for comparable machines used on the ADAM program at Honeywell's Twin City Arsenal, Building 103, New Brighton, Minnesota.

3.5.4 Personnel

Personnel requirements listed below show the number and type of personnel required for the specified mobilization rate of 200,000 sensors per month. These requirements are also based upon a self-contained, stand alone, mature manufacturing line. Concurrent operation of other lines at the same location will reduce these requirements.

Program Management:	Program Manager	1.0
	Quality Manager	1.0
Engineering Supervision:	Production	1.0
	Quality	1.0
Engineering:	Production Engineers	8.0
	Quality Engineer	1.0
	Quality Technician	1.0
	Evaluation Engineer	1.0
Manufacturing:	Assistant Foreman	1.0
	Machine Operators	20.0
	Group Leader	2.0
Tool Room:	Toolmaker	5.0
Inspection:	Receiving Inspection	1.0
	Floor Inspector	3.0
	Floor Group Leader	1.0
Evaluation	Technician	.5
Chem & Met Lab	Engineer	.5
	Chem/X-ray Technician	2.0
Plastics Lab	Engineer	.2
	Technician	1.0

UTILITY USEAGE ANALYSIS

1977 ADAM

PAGE 1 OF 3

1 MACHINE DESCRIPTION & G. NUMBER	2 PART NUMBERS	3 OPER. NO.	4 USEAGE	5 HRS/M	6 AVG. HRS/M	7 KW/M	8 AVG. KW/M	9 KWH/M		10 CF/M	11 CFH/M		12 LBS. STEAM/M	13 LBS. STEAM/M		14 WATER GAL/M	15 WATER GAL/M	
BUILDING 103																			
S & A Assy Machines																			
H28109292T1-1 (#1)	28109292-001	010A		1.24		3.05				950									
H28109293T1-1 (#2)	28109293-001	010A		1.09															
G31509 (#3)	28109293-001	020A		1.97															
G34496 (#4)	28109294-001	010A		1.67															
G31497 (#5)	28109295-001	010A		1.67	7.64	↓	3.05	23.30		↓	7268				C.O. KARSTEN				
Winders															AUG 15 1978				
G31502	28102568-001	010A		.34		2.67				950					PROD ENGR				
G31501	28102567-001	010A		.26															
G30662	28102566-001	010A		.64	1.24	↓	7.67	3.31			1178								
G31411 (Sensor)	28009598-001	010A	(7)	2.94	2.94	13.72	13.72	40.34		↓	2393								
Sensor Assy Machines																			
H28108571T6-1	28108571-001	010A	(7)	10.08		2.29				950									
T6-2	28108571-001	010A	(7)	↓	10.08	↓	2.29	23.08			9576								
T3-1	28108571-001	030A	(7)	6.16	6.16	7.44	7.44	15.03			5852								
G31522	28109250-001	020A	(7)	6.72		2.29													
H28109134T1-1	28109134-001	010A	(7)	3.71	10.43	↓	2.29	23.88			9909								
G31521	28009650-001	010A	(7)	9.73		7.44													
H28009650T6-1	28009650-001	020A	(7)	6.23	15.96	↓	7.44	38.94			15162								
H28108567T1-1	28108567-001	010A	(7)	11.83	11.83	2.51	2.51	29.69			11239								
G31498	28108568-001	010A	(7)	12.74	12.74	2.67	2.67	34.02			12103								
G31499	28109117-001	010A	(7)	13.30	13.30	2.44	2.44	32.45			12625								
H28109117TS-1	28109117-001	022A	(7)	7.91	7.91	13.72	13.72	108.53		↓	1515								
Component Insertion	28107796 TAB	020A		4.00	4.00	4.57	4.57	18.28		3950	15800								
Laser Trim																			
H28107796E100-1	28107796 TAB	090A		10.97	10.97	15.24	15.24	167.18											
Tester																			
H28107796E202-1	28107796 TAB	140A		5.85		7.24													
	28110015 TAB	400A		6.97	12.82	↓	7.24	92.82											
Generator																			
G6162	28107796 TAB	090A		10.97		11.43													
	28107796 TAB	140A		5.85															
	28110015 TAB	400A		6.97	23.79	↓	11.43	271.92											
Molding Machine (MOOV)																			
G6171	28110015 TAB	040A		8.88		48.01				1550									
	28104692-002	040A		OFF															
	28104438-001	060A		3.23	12.11	↓	48.01	581.40		↓	18770								
Wave Solder/Degreaser																			
G6164	28107796 TAB	050A		15.00		12.19													
	28107809 TA6	050A		8.62	23.62	↓	12.19	287.93			18770								

(1792.10)

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10-3-1977

UTILITY USEAGE ANALYSIS

1977 ADAM

1 MACHINE DESCRIPTION & G. NUMBER	2 PART NUMBERS	3 OPER. NO.	4 USEAGE	5 HRS/H	6 AVG. HRS/H	7 KW/H	8 AVG. K./H	9 KWH/H		10 CF/H	11 CFH/H		12 LBS. STEAM/H	13 LBS. STEAM/H		14 WATER SWR/H	15 WATER SWR/H	
BUILDING 103																			
Ovens																			
G6172 (#1)	28110015 TAB	040A		119.76		45.72													
G6205 (#5)	28104692-002	040A		*FT															
G6203 (#6)																			
G6204 (#7)				↓	119.76	↓	45.72	5475.43											
G6170 (Pre-Heat)	28110015 TAB	040A		5.99		30.48													
	28104692-002	040A		2.75	4.37	↓	30.48	133.20											
G6177	28104438-001	060A		6.85	6.85	45.72	45.72	313.18											
G6212	28108853-001	060A		10.00	10.00	10.67	10.67	106.70											
G6152	28009887-001	035A		2.22		10.67													
	28109305-001	020A	(2)	4.44															
	28106829-003	060A		*FT															
	28107975-001	030A		*FS															
	28107916-001	040A		*FS	6.66	↓	10.67	71.06											
G30924	28102566-001	020A		.067		10.67													
G30925	28102567-001	020A		.067															
	28102568-001	020A		.067															
	28009598-001	020A	(1)	.826															
	28109571-001	030A	(1)	.700	1.727	↓	10.67	18.43											
G31401	28111574-001	070A		*FS		8.38													
G31403	28110007-001	070A		5.56	5.56	↓	8.38	46.59											
Epoxy Dip & Cure System																			
G6148	28108724-001	040A		1.00		171.45													
	28108718-001	010A		1.00															
	28107967-001	010A		*FS															
	28107746-001	010A		*FT															
	28009914-001	010A		1.00	3.00	↓	171.45	514.35											
Degreasers	28104489-001	030A		.66						950									
G6160 (XYDAX)	28110015 TAB	760A		1.82		8.62													
	28104438-001	020A		1.01	3.49	↓	8.62	30.09			3315								
G6149	28110014-001	050A		2.87		5.33													
	28106829-003	090A		*FT															
	28111572-001	080A		*FS	2.87	↓	5.33	15.30			2727								
Boron/Blakeslee 2	28102498-001	006A		.04		22.43													
(Monthly unit # 3454) 5	28102499-001	006A		.01	.02	↓	22.43	.55		↓	19								
Emralon																			
G6197	28102498-001	010A		.044		6.10													
	28102499-001	010A		.044	.088	↓	6.10	.54											
Hydraulic Press																			
G6166	28110003-001	010A		28.08	28.08	3.81	3.81	106.98											
Belt Sander																			
G6174	28110015 TAB	535A		2.61	2.61	2.29	2.29	5.98											
								6837.82			6042								

OUT

UTILITY USEAGE ANALYSIS

1977 ADAM

PAGE 3 OF 3

1 MACHINE DESCRIPTION & G. NUMBER	2 PART NUMBERS	3 OPER. NO.	4 USEAGE	5 HRS/M	6 AVG. HRS/M	7 KW/H	8 AVG KW/H	9 KWH/M		10 CF/H	11 CFH/M		12 LBS. STEAM/H	13 LBS. STEAM/H		14 WATER SUB/H	15 WATER SUB/H	
BUILDING 103																			
Sandblaster																			
G6175	28104692-002	400A		FT		9.14				2450									
	28110015 TA8	660A		3.30															
	28104438-001	144A		3.30															
G6206	28102893-001	010A		1.85															
	28103391-001	010A		1.46	9.91	↓	9.14	90.58		↓	27280								
Tubing Cutter																			
G6150	28010223-001	010A	(2)	.44		2.00													
	28010223-002	010A		.28															
	28010223-003	010A	(2)	.48															
	28010223-004	010A	(5)	.70															
	28010223-006	010A		.12															
	28010223-007	010A		.13	2.15	↓	2.00	4.30											
Wire Cutter																			
G6151	28105968-001-M1	010A		FT		8.3				950									
	28105968-001-M2	010A	(5)	2.5															
	28105968-001-M3	010A	(4)	2.0															
	28105968-001-M4	010A		FT															
	28105968-002-B4	010A		FT															
	28105968-002-B4½	010A		FT															
	28105968-003-B8	010A		FT															
	28105968-003-R4	010A		0.5															
	28105968-003-R8	010A		FT															
	28105968-003-Y4	010A		0.5															
	28105968-003-Y8	010A		FT															
	28105968-003-Y9	010A		FT	5.5	↓	8.3	45.65		↓	5225								
Disc Grinder																			
G4518	28110015 TA8	600A		4.00		16.76													
G31418				↓	4.00	↓	16.76	67.04											
AD Switch Tester																			
H28102127-E3-1	28108853-001	080A		4.74		5.0													
H23102127-E3-2	28108853-001	080A		↓	4.74	↓	5.0	23.70											
Welders																			
H28107809-T8	28107809 TA8	090A		8.61		5.0													
H28109649-T3	28109649-001	030A		4.95	13.56	↓	5.0	67.80											
				BUILDING TOTAL (103) →				8218.99			165,337								
								8218.99			29805								
								-299.07											

4.0 TEST/VERIFICATION

Test and verification of the GEMSS Extended Tripline Sensor Special Automatic Assembly Line shall be accomplished by conducting a demonstration test on each Special Automatic Assembly Fixture (SAAF). Demonstration Test Plans shall be prepared for each SAAF to assure that SAAF requirements are met and that Extended Tripline Sensor Assemblies conform to MIL-S-48755.

a. During the conduct of the demonstration test, Reliability, Availability and Maintainability (RAM) data shall be recorded by failure indicating:

- Cause of failure
- Corrective action
- Time to determine corrective action
- Time to perform corrective action
- Total down time per failure

This data will be part of the reliability analysis.

b. During the conduct of the demonstration test, the following shall be recorded:

- Date of demonstration test
- Start time
- Stop time (Stops will be recorded by number displayed and/or reason for stop and duration of stop)
- Observed time
- Total run time
- Total down time

- Cycle rate (CPM0
- Total cycle count
- Total parts count
- Lot number of parts and material assembled

This data will be part of the engineering evaluation.

c. During and/or following the demonstration test, samples of SAAF-accepted assemblies shall be selected and inspected and/or tested for conformance to MIL-S-48755. The inspection results will be part of the Quality evaluation.

d. Installation testing and checkout shall consist of the following:

- All feed, work and probe stations function properly.
- Control system functions properly.
- SAAF-accepted assemblies conform to MIL-S-48755

APPENDIX B

EQUIPMENT TECHNICAL DATA PACKAGE SPECIFICATION FOR SPECIAL AUTOMATIC ASSEMBLY LINE FOR XM74 GEMSS EXTENDED TRIPLINE SENSOR

SPECIFICATION TS 578-4869

DARCOM Project
578-4869

AUGUST 1978

Preparing Organization

Honeywell Inc.
Defense Systems Division

94580

TABLE OF CONTENTS

TABLE OF CONTENTS (Concluded)

1.0 SCOPE

1.1 Equipment Data Specification

This Equipment Technical Data Specification establishes the performance, design, test, manufacture and acceptance requirements for Special Automatic Assembly Fixtures (SAAF) used in the fabrication of the XM74 GEMSS Extended Range Tripline Sensor.

This equipment is tabulated (ref: Table B-1) to show each machine by name and number. A listing of parts assembled and commonality with ADAM Sensor Assembly Machine is also given.

2.0 APPLICABLE DOCUMENTS

2.1 Document Specification

The following documents, of the issue in effect on the date of beginning activity on this contract, shall form a part of this specification to the extent specified herein:

Standards	
MIL-STD-1472	Human Engineering Design Criteria for Military Systems, Equipment and Facilities.
Drawings	
9292972	Extended Range Tripline Sensor
Specifications	QAP - GEMSS-1 Extended Range Tripline Sensor

TABLE B-1. MACHINE TABULATION

Machine Number	Machine Name	Parts Assembled		Commonality
7	Bobbin Assembly 9292982	9292983	Weight	New
		9292985	Bobbin	
		9298591	Tape	
		9298592	Thread	
8	Diaphragm Assembly 9292998	9298597	Diaphragm Plate	Common
		9298598	Diaphragm	
		9298599	Diaph. Eyelet	
		9298618	Fibrous Gasket	
9	Housing Assembly 9298587	9298588	Housing, Cup	Common
		9298589	Housing, Tube	
10	Release Mech. Assy. 9292991 Less Terminals	9298582	Washer Spring	Common
		9298586	Ring, Ball Lock	
		9292998	Diaphragm Assy.	
		9298587	Housing Assy.	
10A	Terminal Assy. 9292991 (Release Mech. Assy.)	9298601-1	Terminal, Breakwire	Common
		9298601-2	Terminal, Breakwire	
11	Release Mech. and Case Assembly 9292986	9292987	Sensor Case	Modified
		9292988	Sleeve	
		9292989	Case, Washer	
		9298581	Locking Ball	
		9292991	Release Mech. Assy.	
12B	Release Mech. and Case Assembly	9292981	Interface Eyelet	New
		9292990	Booster Spring	
		9298578	Ejection Spring	
		9292986	Case/Sleeve Assy.	
12	Sensor Case/Bobbin Assembly 9292976	9292980	Anchor	Modified
		9298579	Cap	
		9298581	Locking Ball	
		9292986	Release Mech./Case Assy.	
		9292982	Bobbin Assembly	
13	Sensor & B/W Assy.	9298575	Post, Cover	Modified
		9298576	Magnet Wire	
		9298577	B/W Retaining Ring	
		9292976	Sensor Case/Bobbin Assy.	
13A	Epoxy Dispenser 9292972 Extended Range Tripline Sensor	9298617	Adhesive Spec. MMM-A-132 Type 1, Class 3	Modified

2.2 NON-GOVERNMENT DOCUMENTS - NOT APPLICABLE

3.0 REQUIREMENTS

3.1 Item Definition

The XM74 (Extended Tripline) automated machine line described herein is a group of unique machines that result in a complete and acceptable XM74, Extended Range Tripline Sensor.

3.1.1 Item Diagrams -- Figure B-1 shows the total machine line flow of the Sensor Assembly. Following this diagram are dial layouts and descriptions indicating the functions performed on each machine.

3.1.2 Interface Definition -- The SAAF for the GEMSS Sensor Assembly Line will consist of 10 Special Built Assembly Fixtures. They will run independent of each other. The controlling factor will be availability of parts and assemblies from previous SAAF's.

The GEMSS Sensor Line will run at various rates (assemblies/per hour) due to the complexity of the various assemblies, therefore, a comparison of hours per month multiplied by the expected RAM rate predicted (PCS/HR) has been compiled to identify the specific functional interface requirements (Ref: Table B-2).

Physical interface relationships are specified on tooling drawings for the individual SAAF Station, Base, Dial, or Tooling Plate. These drawings will be furnished with the SAAF's in almost all instances. Special drawings are required for each station and probe.

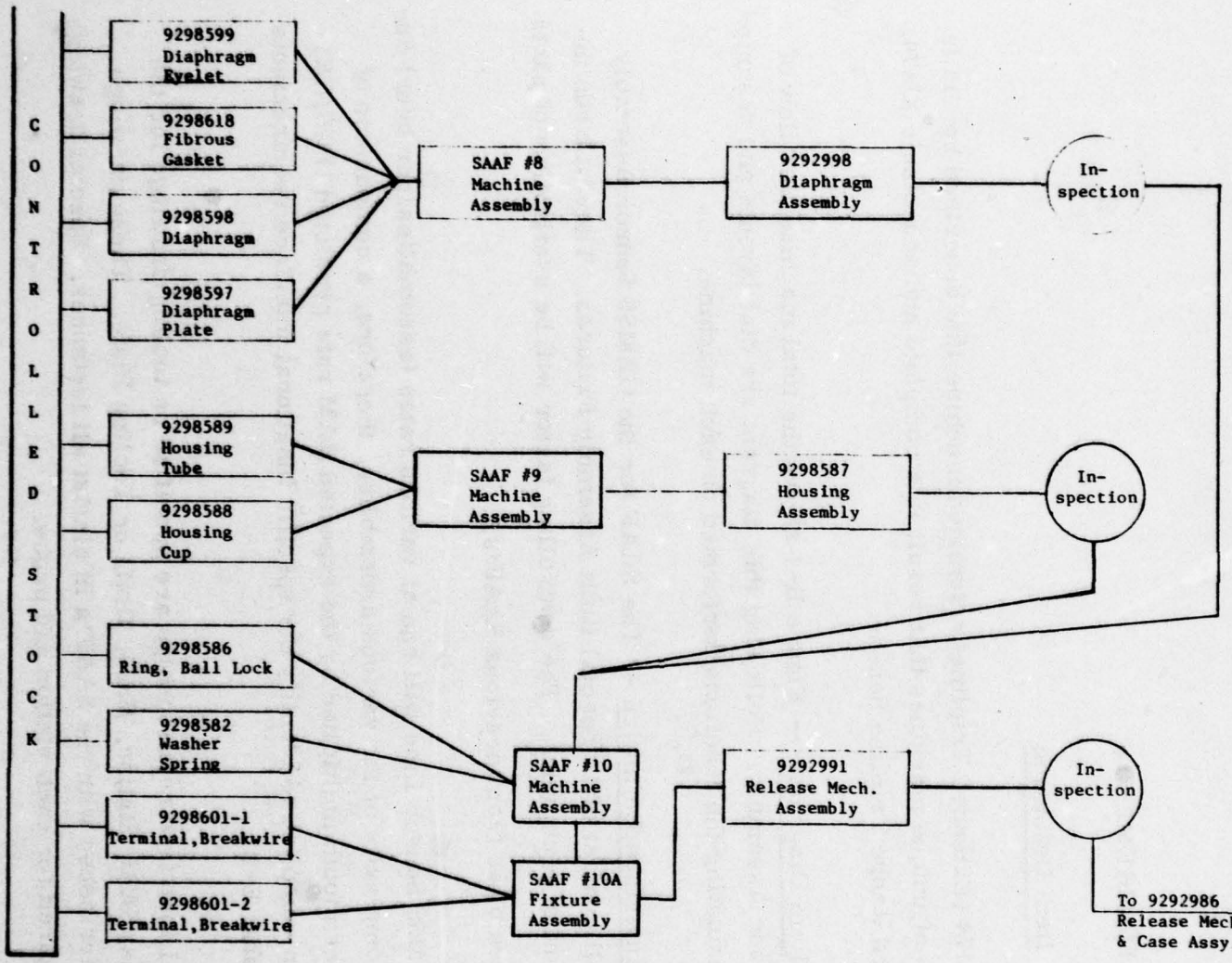


Figure B-1. Extended Tripline Sensor Subassembly Flow Chart

TS 578-4869

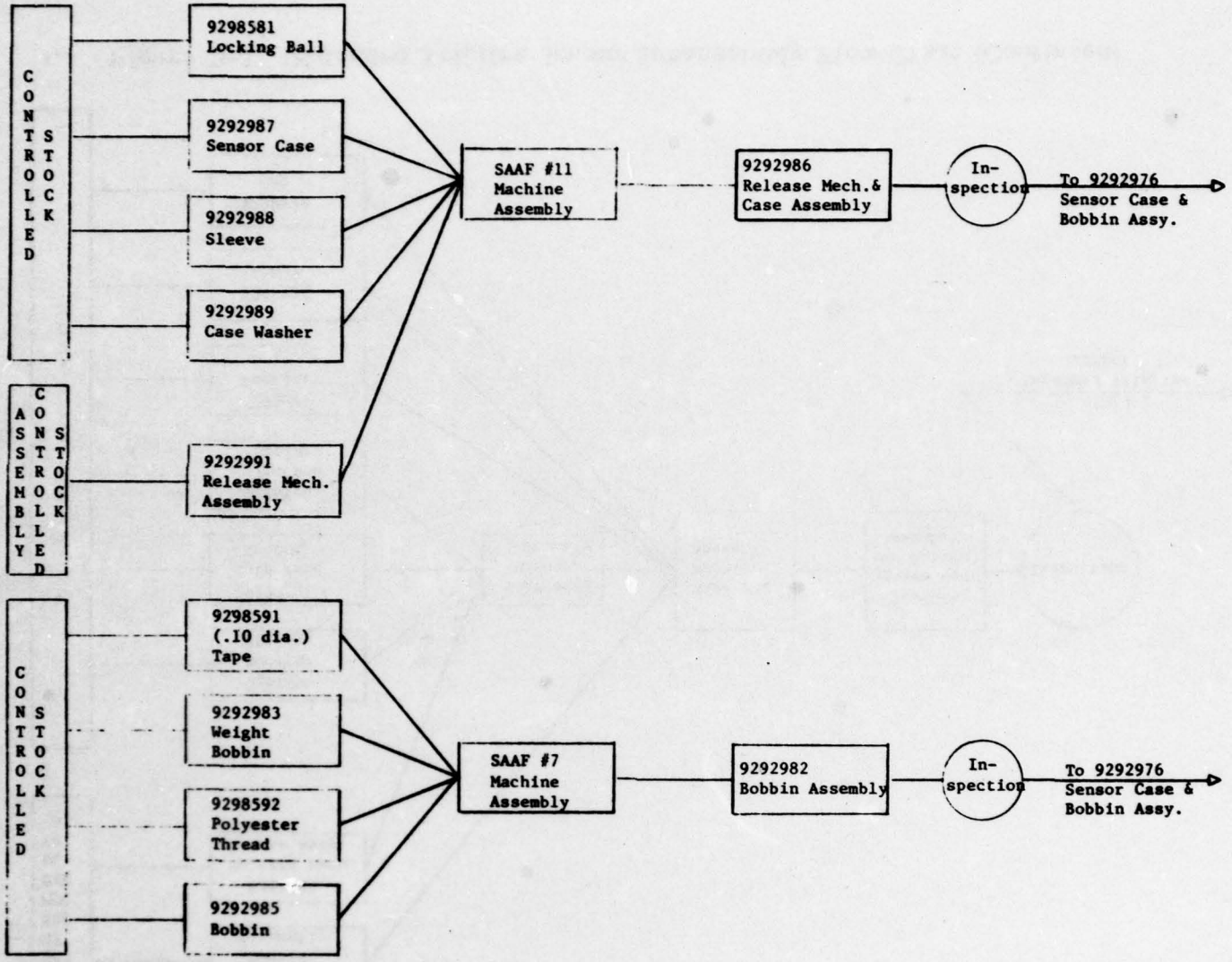


Figure B-1. Extended Tripline Sensor Subassembly Flow Chart (Continued)

TS 578-4869

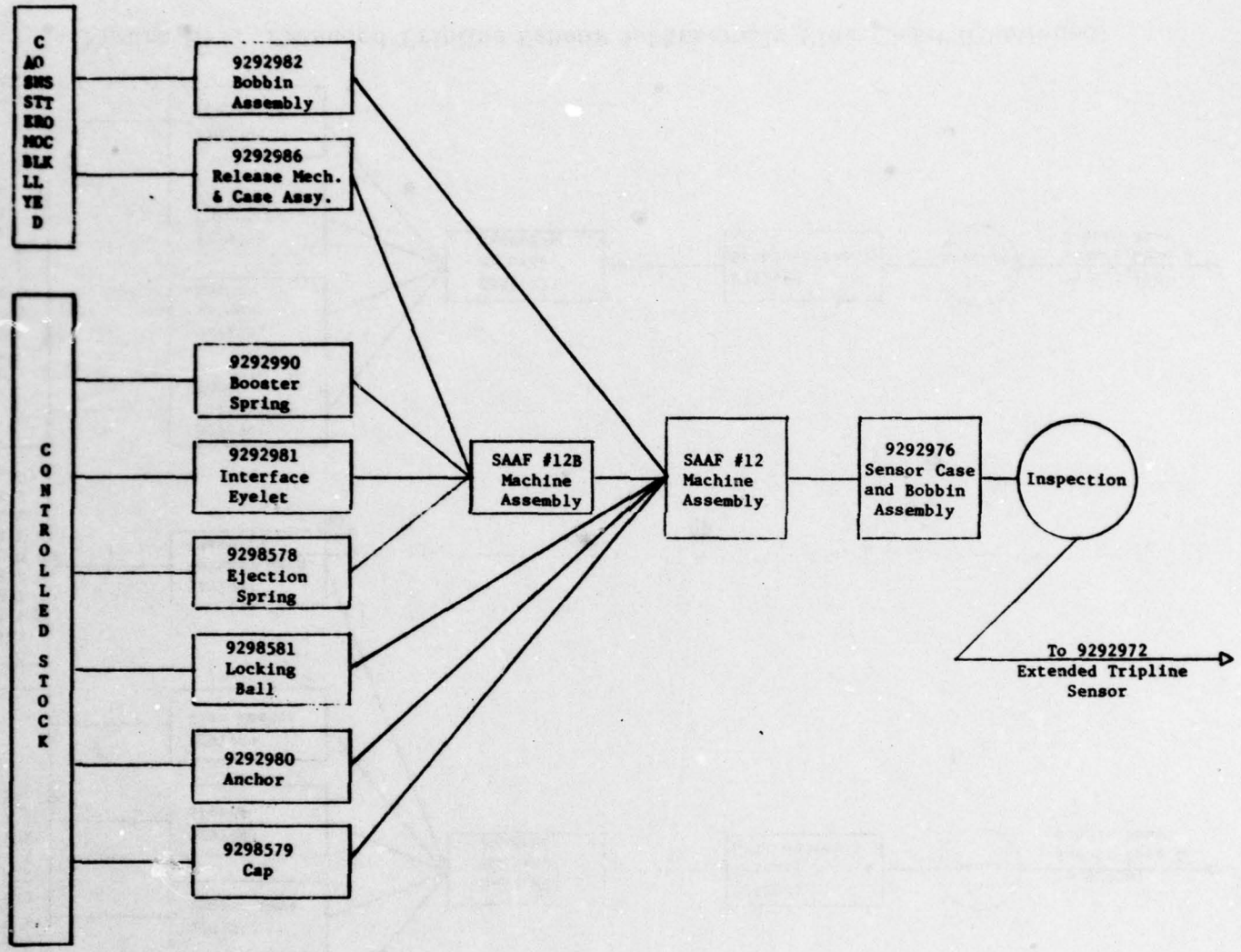


Figure B-1. Extended Tripline Sensor Subassembly Flow Chart (Continued)

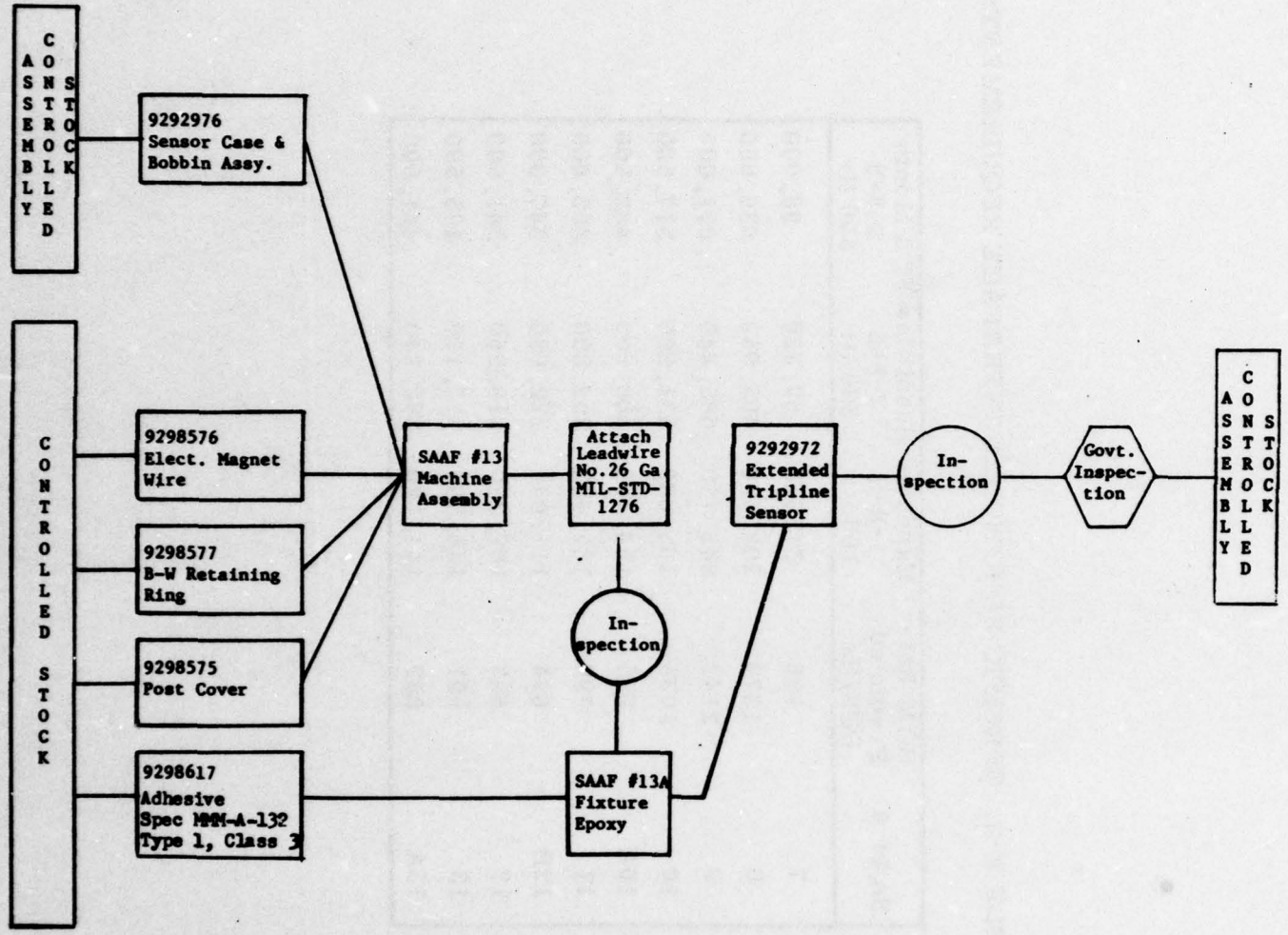


Figure B-1. Extended Tripline Sensor Subassembly Flow Chart (Concluded)

TABLE B-2. SPECIFIC FUNCTIONAL INTERFACE REQUIREMENTS

SAAF #	RAM Rate Predicted PCS/Hr	Expected Quantities PCS/Month 1-8-5 160 Hr	2-8-5 320 Hr	3-8-5 500 Hr
7	196	31,360	62,720	98,000
8	1272	203,520	407,040	636,000
9	2142	342,720	685,440	1,071,000
10	1035	165,600	331,200	517,500
10A	965	154,400	308,800	482,500
11	790	126,400	252,800	395,000
12B	694	111,040	222,080	347,000
12	683	109,280	218,560	341,500
13	991	158,560	317,120	495,500
13A	882	141,120	282,240	441,000

As much as possible, the contractor should use standard off the shelf items for the electrical and pneumatic systems.

3.1.3 Major Component List -- Honeywell Ordnance Machine Lab (OML) Automation Equipment is designed and built to standardized configurations whenever possible. The Machine Development Laboratory has designed and built more than 1100 automatic assembly machines in recent years and has available extensive tools and equipment to support machine build programs. The magnitude of OML operations has permitted standardization of special machines to a high degree. Enclosed as an attachment to this specification is a booklet entitled Automation Standard Equipment. This booklet is a catalog of major components which have also been referenced on the design drawings for the assembly machines to be used for building the XM74 GEMSS Extended Range Tripline Sensor.

3.1.4 Government Furnished Property List -- With respect to the XM74 GEMSS Sensor, no Government-furnished equipment is required specifically for the Automatic Assembly Line. Due to similarities between the ADAM and GEMSS lines there will be common usage of the following facility items:

- Demagnetizer
- Ultrasonic Cleaner-Degreaser
- Humidity Controlled Room

These facilities would be placed between the two lines.

3.2 Characteristics

3.2.1 Performance Characteristics -- Special automatic assembly fixtures will produce 750 to 1250 completed assemblies per hour, depending upon the complexity of the assembly. Machine descriptions are given on the following pages.

MACHINE #7
BOBBIN WINDER

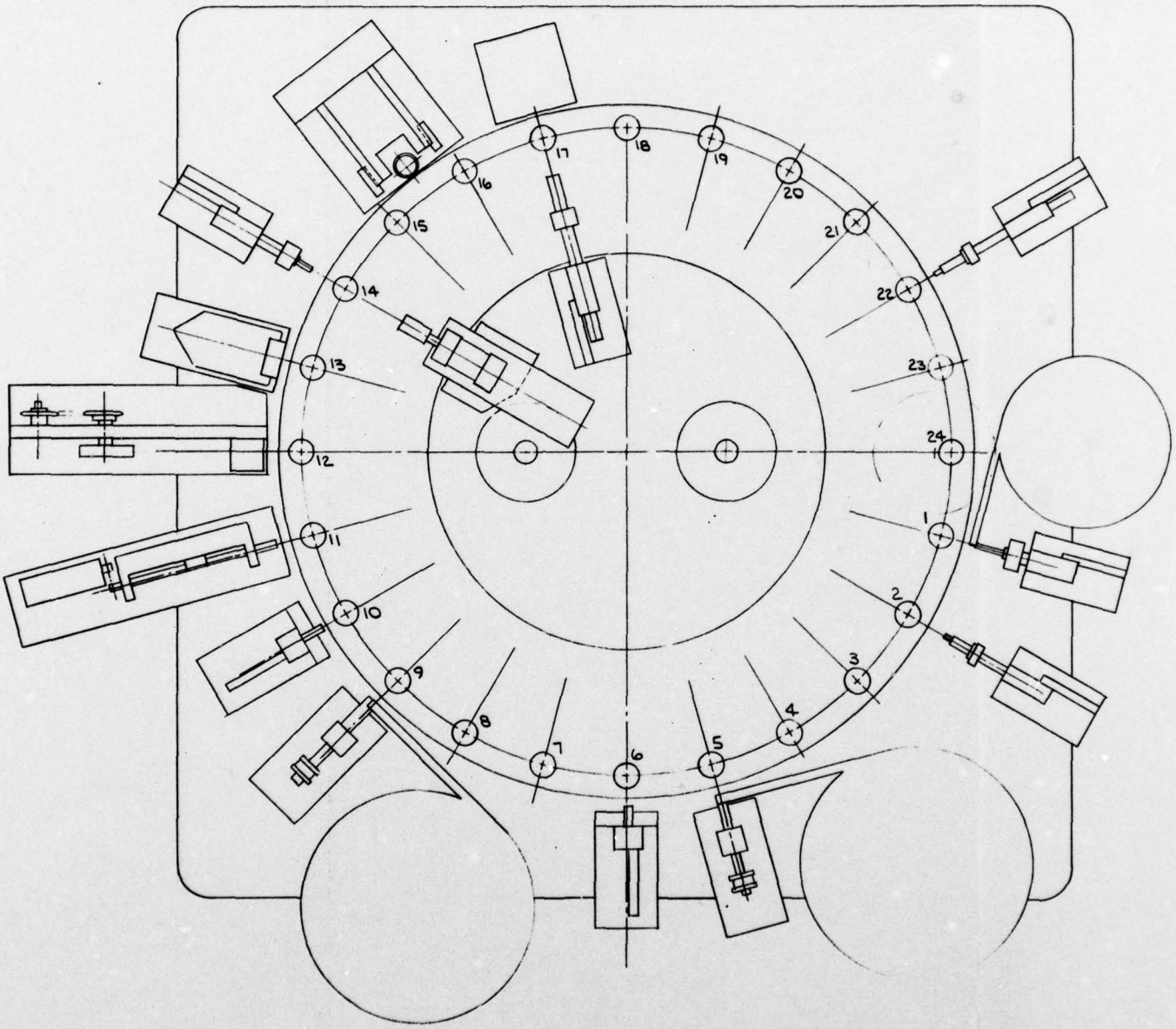
APPLICABLE PIECE PARTS

•	Bobbin	Print #9292985
•	Weight	Print #9292983
•	Tape	Print #9298591
•	Thread	Print #9298592
•	Bobbin Assembly	Print #9292982

MACHINE OPERATIONS

This machine (Figure B-2) is required to assemble the bobbin and weight with 46 feet of thread wrapped around the bobbin. The thread is held on the face of the bobbin by an adhesive tape and maintained in the rear by a press fit between the bobbin and weight. The sequence of machine operations is as follows:

1. Bobbin weights are placed onto the nest and positioned.
2. Bobbin is placed onto the nest in front of the weight.
3. The thread is wound onto the bobbin with 1/2 turn located in the weight cavity of the bobbin and with 46 feet along the body. A final 3 wraps is done on the bobbin post.
4. The thread is taped into position on the bobbin face. This tape is sealed by a heating operation.

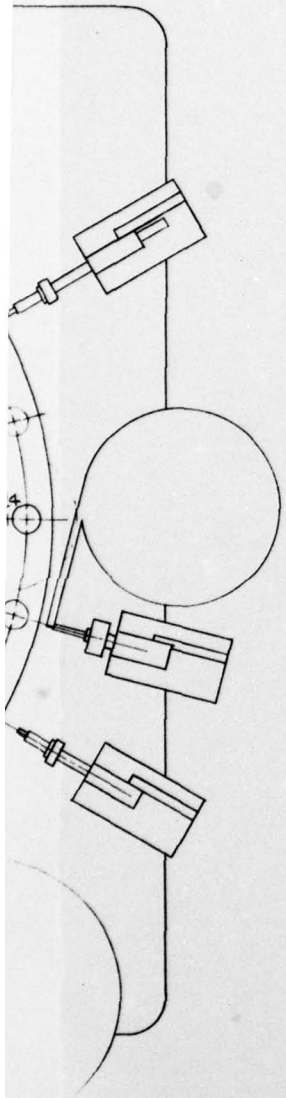


A						ORIGINAL DRAWING		
SYM		DATE	ENG	Q.C.	SUPV.	REVISIONS		TL. DESIGNER

DF 17C 4/77

Figure P-2. Machine #7 Bobbin Winder

4 3 DON'T FORGET SAFETY 2 1



STA NO.	OPERATION	PART NO.
1	FEED WEIGHTS BOTH NESTS	9292983
2	PROBE WEIGHTS PRES.&POS. BOTH NESTS	
3	IDLE	
4	IDLE	
5	FEED BOBBIN LOWER NEST	9292985
6	PROBE BOBBIN PRES.&POS. LOWER NEST	
7	IDLE	
8	IDLE	
9	FEED BOBBIN UPPER NEST	9292985
10	PROBE BOBBIN PRES.&POS. UPPER NEST	
11	WIND THREAD BOTH NESTS	9292984
12	TAPE STATION BOTH NESTS	9293003
13	HEAT SEAL STATION BOTH NESTS	
14	PRESS WEIGHT TO BOBBIN& PROBE - BOTH NESTS	
15	CUT THREAD	
16	CUT THREAD	
17	EJECT TO CONTAINER BOTH NESTS	
18	IDLE	
19	IDLE	
20	IDLE	
21	IDLE	
22	PROBE EMPTY NEST BOTH NESTS	
23	IDLE	
24	IDLE	

D C B A

REF. DESIGNATOR	QTY.	REQ.	NAME	FINISHED SIZE	DESCRIPTION	MATERIAL	HEAT TRT.	FIN.
	TOLERANCES UNLESS NOTED	SCALE	—	DATE	Honeywell			
		TL. DSGR.	K.W.S.	8-15-78	NAME			
	MACH. ±1/64 FRACTIONS ±1/32	DETAILER			TOP LAYOUT			
	ONE PLC. DEC. ±.040	CHECKED			BOBBIN ASSEMBLY			
	TWO PLC. DEC. ±.010	SUPV.	[illegible]	4-28-78	SAAF #7			
	THREE PLC. DEC. ±.005	ENG.	[illegible]	4-19-78	DRAWING NO. XM74			
	FOUR PLC. DEC. ±.0005	MFG.			SHEET NO. 1 NO. SHEETS 1 SIZE D	77-9610-AE		
REF. SHEET								

4 3 2 1 A

ine #7 Bobbin Winder

Reverse side is blank

5. The nest is compounded to press the weight into the weight cavity maintaining the thread in the rear of the bobbin.

6. Excess thread in the operation is removed.

7. The final Bobbin Assembly is ejected off the machine in bulk.

MACHINE #8
DIAPHRAGM ASSEMBLY

APPLICABLE PIECE PARTS

•	Fibrous Gasket	Print #9298618
•	Eyelet Diaphragm	Print #9298599
•	Diaphragm	Print #9298598
•	Plate Diaphragm	Print #9298597
•	Diaphragm Assembly	Print #9292998

MACHINE OPERATIONS

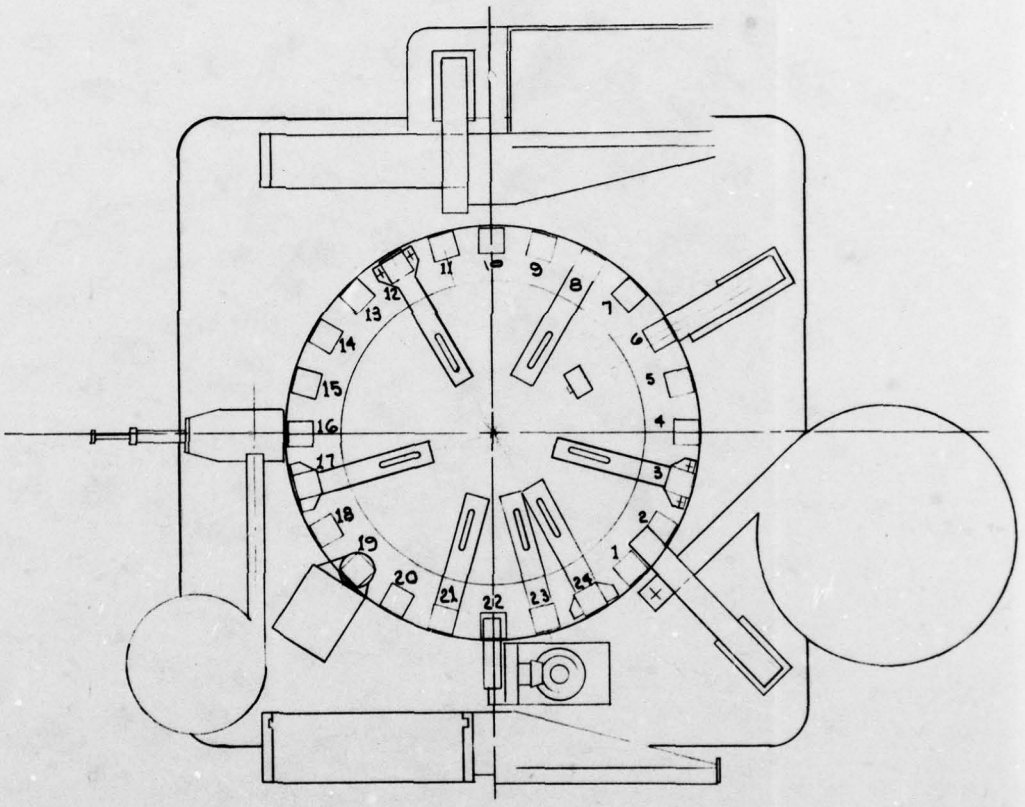
This machine (Figure B-3) is required to assemble an eyelet, diaphragm, plate diaphragm and gasket to form the diaphragm assembly. This completed assembly is fed as a unit to Machine #10. The sequence of machine operations is as follows:

1. First, the plastic diaphragm plate is fed to the nest from a vibratory bowl.

2. Now, a gasket is blanked from a continuous roll of material and placed into position on the diaphragm plate.

3. Next, the diaphragm is fed from magazines to the nests. It is positioned on top of the two previous piece parts.

STRIVE TOWARD ERROR-FREE PERFORMANCE



OML 452

B		10/1977				ORIG. REDRAWN (REDRAWN)	WGate.
A						ORIGINAL DRAWING T.N. WAS 77-3607-AC	
SYM		DATE	ENG	G.C.	SUPV.	REVISIONS	TL ASSIGNED

DF ITC 3/76

Figure B-3. Machine #8 Diaphragm Assembl

DON'T FORGET SAFETY

STA No.	
1	HOPPER FEED DIAPHRAGM PLATE
2	IDLE
3	PROBE PRESENCE & POSITION
4	IDLE
5	IDLE
6	BLANK FORM & FEED GASKET
7	IDLE
8	PROBE OPTICALLY
9	IDLE
10	MAGAZINE FEED DIAPHRAGM
11	IDLE
12	PROBE PRESENCE & POSITION
13	IDLE
14	IDLE
15	IDLE
16	HOPPER FEED EYELET
17	PROBE PRESENCE & POSITION
18	IDLE
19	STAKE EYELET
20	IDLE
21	PROBE STAKED EYELET
22	EJECT TO MAGAZINE
23	REJECT
24	PROBE EMPTY NEST

OML 452 BASE

REF. DESIGNATOR	QTY.	REQ.	NAME	FINISHED SIZE	DESCRIPTION	MATERIAL	HEAT TRT.	FIN.
	TOLERANCES UNLESS NOTED	SCALE		DATE	Honeywell			
		TL. DSGR.	W.G.B.	10-3-77	NAME TOP LAYOUT			
		DETAILER			SENSOR, DIAPHRAGM ASSY SAAF			
	MACH. ±1° FRACT. ±.0	CHECKED			ADAM SAAF 8			
	ONE PLC. DEC. ±.040	SUPV.	JHH	3-14-78	DRAWING NO.			
	TWO PLC. DEC. ±.000	ENG.			SHEET NO. 1 NO. SHEETS 1 SIZE D H28109250-T8-1			
	THREE PLC. DEC. ±.005							
	FOUR PLC. DEC. ±.0000	Q.C.						
REF. SPEC.								

ine #8 Diaphragm Assembly

Reverse side is blank

2

4. Then an eyelet is fed from a vibratory bowl. This eyelet is crimped to hold these piece parts together.

5. Following the crimping operation, the assembly goes through a notching station where the diaphragm is notched to provide clearance for the spout.

6. The final station is the point where the assembly is ejected to a magazine.

MACHINE #9
HOUSING ASSEMBLY

APPLICABLE PIECE PARTS

- Tube Housing — Print #9298589
- Cup Housing — Print #9298588
- Housing Assembly — Print #9298587

MACHINE OPERATIONS

Two piece parts are involved in this assembly (Figure B-4). The tube and cup housing are assembled to form the housing assembly. The sequence of machine operations is as follows:

1. First, the housing tube is fed from a vibratory bowl onto the nest.
2. Next, the housing cup is fed from a vibratory bowl and positioned on top of the housing tube.
3. The two pieces are fixed together by a staking operation.
4. This final assembly is now ejected in bulk.

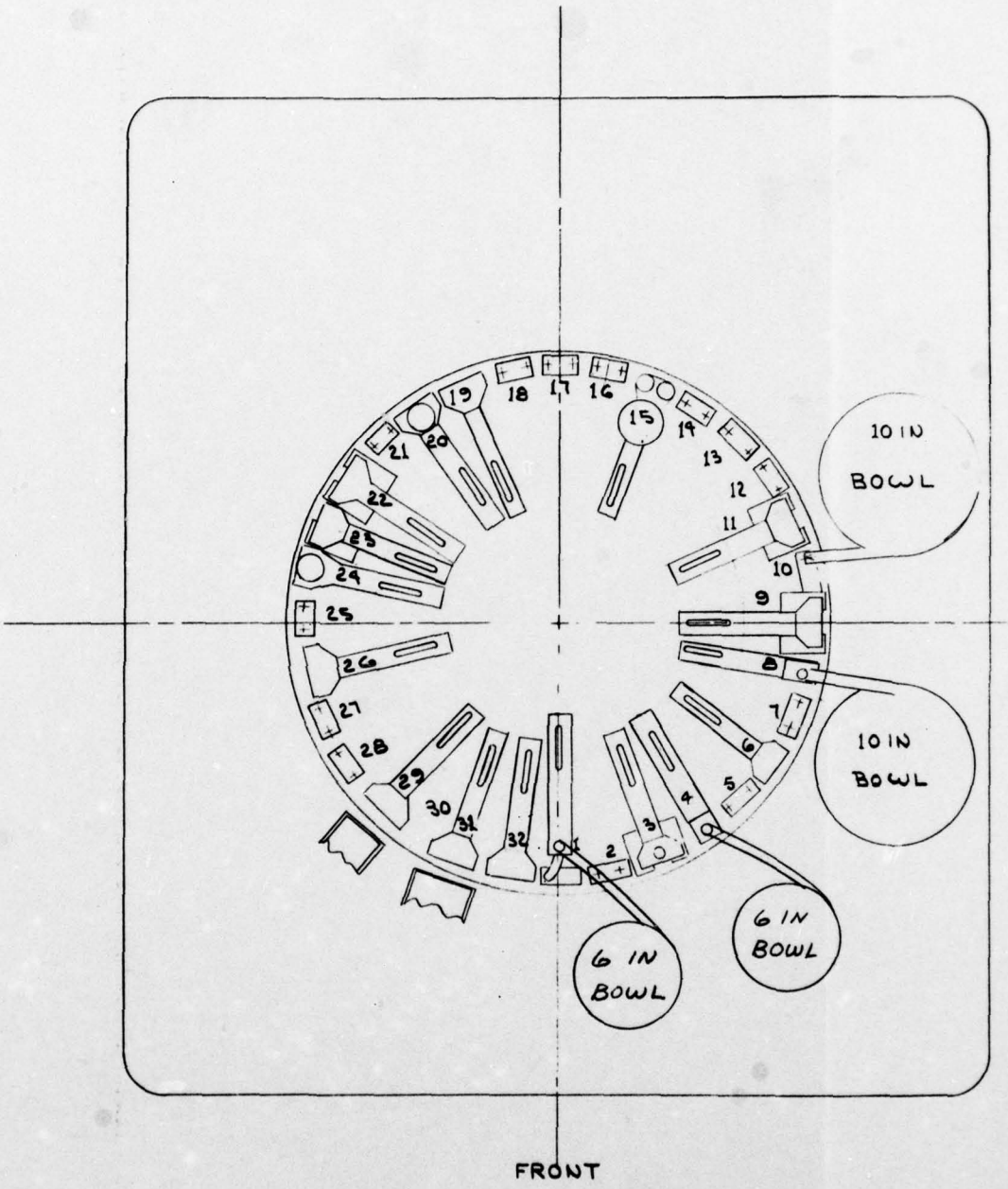
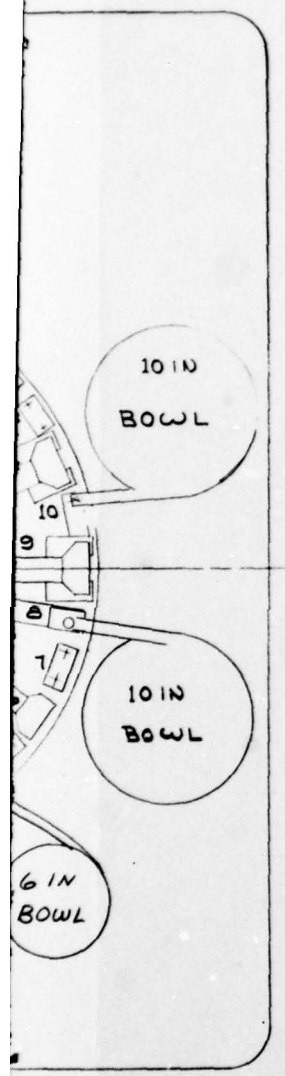


Figure B-4. Machine #9 Housing Assembl

DON'T FORGET SAFETY



1	HOPPER ORIENT & FEED TUBE
2	IDLE
3	PROBE PRESENCE & POSITION
4	HOPPER ORIENT & FEED TUBE
5	IDLE
6	PROBE PRESENCE & POSITION
7	IDLE
8	HOPPER FEED CUP
9	PROBE PRESENCE & POSITION
10	HOPPER FEED CUP
11	PROBE PRESENCE & POSITION
12	IDLE
13	IDLE
14	IDLE
15	ORIENT CUPS TO TUBES
16	IDLE
17	IDLE
18	IDLE
19	PROBE ORIENT POSITION
20	STAKE TUBE
21	IDLE
22	PROBE STAKE
23	PROBE ORIENT POSITION
24	STAKE TUBE
25	IDLE
26	PROBE STAKE
27	IDLE
28	IDLE
29	EJECT TO CONTAINER (2)
30	IDLE
31	REJECT TO CONTAINER
32	PROBE EMPTY NEST

OML 451 BASE

REF. SEC. STATUS	QTY.	REQ.	NAME	FINISHED SIZE	DESCRIPTION	MATERIAL	HEAT TRT.	PHIL.
			TOLERANCES UNLESS NOTED	SCALE		DATE	Honeywell				
				TL. SIGN.	C.J.G.B.	10-21-77	TOP VIEW LAY OUT				
				DETAILER			HOUSING ASSY				
				CHECKED			ADEM SCAF 9				
				SUPV.	J.H.A.	3-13-78	SHEET NO. 1	NO. SHEETS 1	SIZE D	DRAWING NO. H28109134-T2-1	
				ENG.							
REF. DWGS.				B.C.							

MACHINE #10
RELEASE MECHANISM ASSEMBLY

APPLICABLE PIECE PARTS

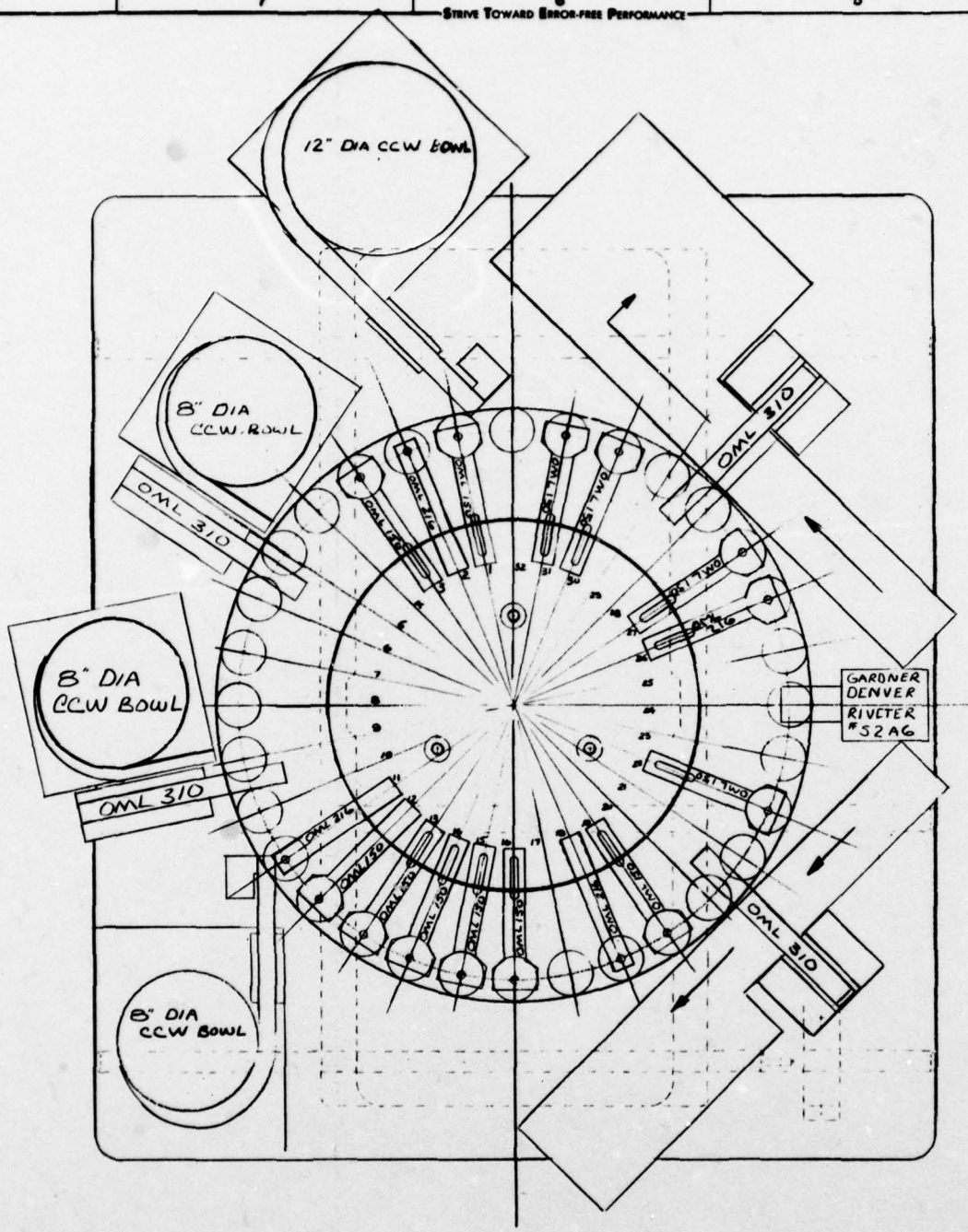
- Spring, Washer — Print #9298582
- Ring Lock — Print #9298586
- Housing Assembly — Print #9298587
- Diaphragm Assembly — Print #9292998

MACHINE OPERATIONS

This machine is required to assemble the housing assembly (from Machine #9) and diaphragm assembly (from Machine #8) along with two washer springs and a lock ring (Figure B-5). This entire assembly is the release mechanism without the breakwire terminals. The sequence of assembly machine operations is as follows:

1. First, the housing assembly is fed from a vibratory bowl. It is oriented in the nest by a spin station.
2. Next, two springs are fed into the housing assembly. These are also fed from a vibratory bowl.
3. Then a ring lock is positioned on top of the two springs and three separate stations exercise the springs.
4. Now, the springs are compressed and nest slides are used to captivate the assembly.

STRIVE TOWARD ERROR-FREE PERFORMANCE



B		11/16/77				ADD STATION 266 CHANGE 27	GWGG
A	-	9/20/77				ORIGINAL DRAWING T.N. WAS 77-3607-AE	NJN
SYM	REV	DATE	ENG	Q C	SUPV	REVISIONS	TL DESIGNER

DF 17C 5/76

Figure B-5. Machine [illegible] Release Mechanism

DON'T FORGET SAFETY

STATION NO.	OPERATION
1	FEED HOUSING ASSEMBLY
2	ORIENT HOUSING
3	PROBE HOUSING ORIENT
4	IDLE
5	FEED SPRING WASHER
6	IDLE
7	IDLE
8	IDLE
9	FEED SPRING WASHER
10	IDLE
11	FEED BALL LOCK
12	PROBE BALL LOCK
13	EXERCISE BALL RING
14	EXERCISE BALL RING
15	EXERCISE BALL RING
16	PROBE
17	IDLE
18	ORIENT BALL RING, CLOSE NEST
19	PROBE BALL RING (POSITION)
20	FEED DIAPHRAGM
21	IDLE
22	PROBE DIAPHRAGM
23	IDLE
24	CRIMP
25	IDLE
26	PROBE CRIMP
27	OPEN NEST
28	EJECT
29	IDLE
30	REJECT
31	PROBE EMPTY NEST
32	IDLE

OML 451 BASE

REF. DESIGNATOR	DEV.	REQ.	NAME	FINISHED SIZE	DESCRIPTION	MATERIAL	HEAT TRT.	FINISH
MASTER DRAWING O.D. MASSING DEC. 2, 1976			TOLERANCES UNLESS NOTED	SCALE 1/4 X	DATE	Honeywell		
				TL. DSGN. NJN	9/20/77	NAME		
				DETAILER		TOP LAYOUT		
			MACH. ∠1°- FORGED ∠2°-	CHECKED		SENSOIR RELEASE MECH. ASS'Y.		
			ONE PLC. DEC. ±.040	SUPV.	5 OCT 77	ADAM	SAAF # 10	
			TWO PLC. DEC. ±.020	ENG.		SHEET NO. 1	NO. SHEETS 1	SIZE D
			THREE PLC. DEC. ±.010	Q.C.		DRAWING NO. H28009650-T13-12		
			FOUR PLC. DEC. ±.0050					
REF. SHEET								

OML 451 MASTER

e #10 Release Machanism Assembly

Reverse side is blank

2

5. The diaphragm assembly is fed from magazine and placed on top of the nest.

6. The diaphragm assembly is staked to the remainder of the assembly and the nest slides are retracted. Following this the assembly is ejected to a magazine.

MACHINE #10A
TERMINAL ASSEMBLY FIXTURE

APPLICABLE PIECE PARTS

- Terminal, Breakwire — Print #9298601
- Release Mechanism Assembly — Print #9292991

MACHINE OPERATIONS

This fixture (Figure B-6) assembles the terminals (left and right side) to the release mechanism. The sequence of machine operations is as follows:

1. The magazines containing the release mechanisms are utilized as a nest. The fixture indexes the magazines through the assembly operations.
2. Next, breakwire terminals are punched from strip stock and positioned onto the release mechanism.
3. Finally, these terminals are held in place by heating and forming two plastic ears on the release mechanism.

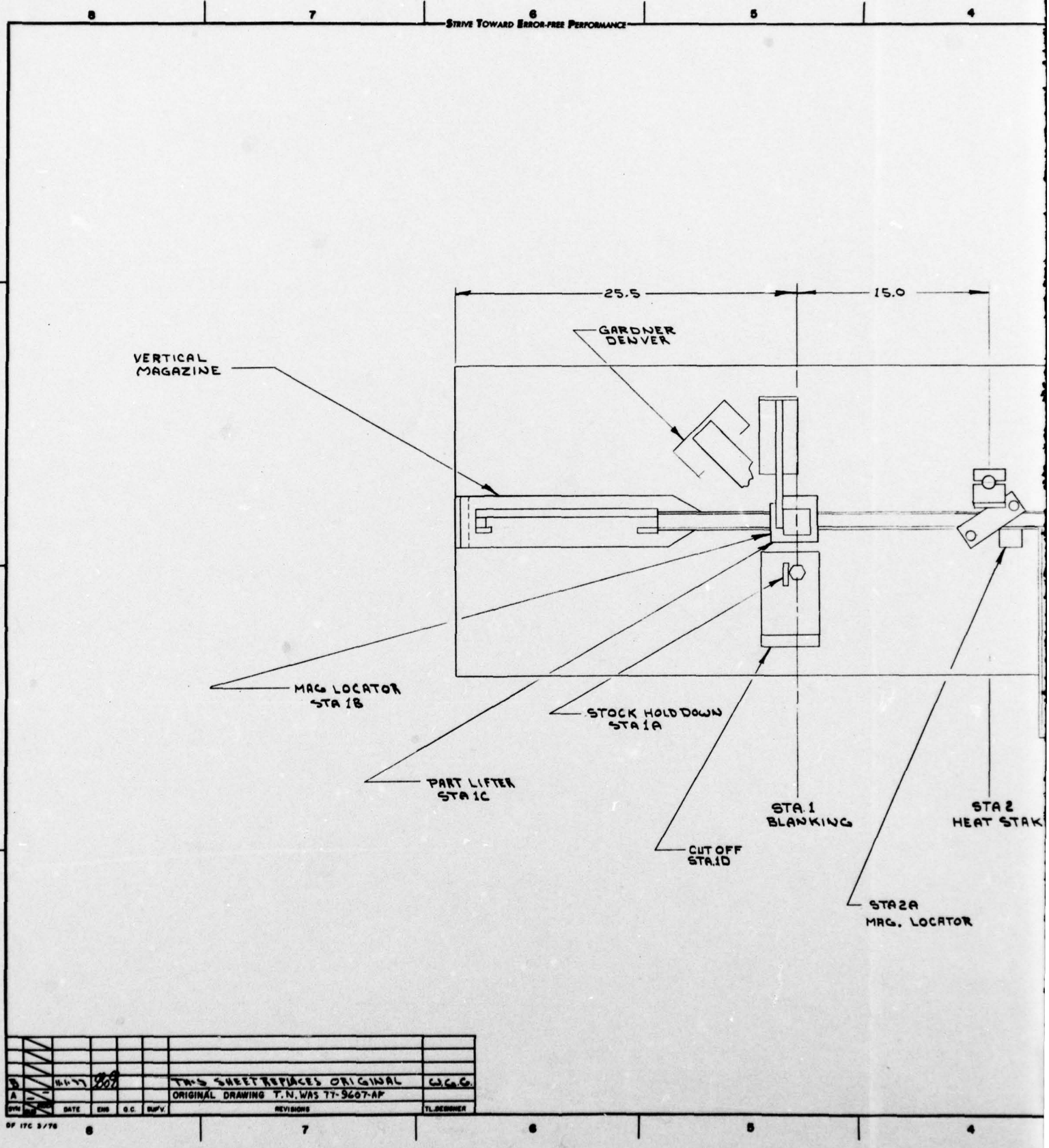
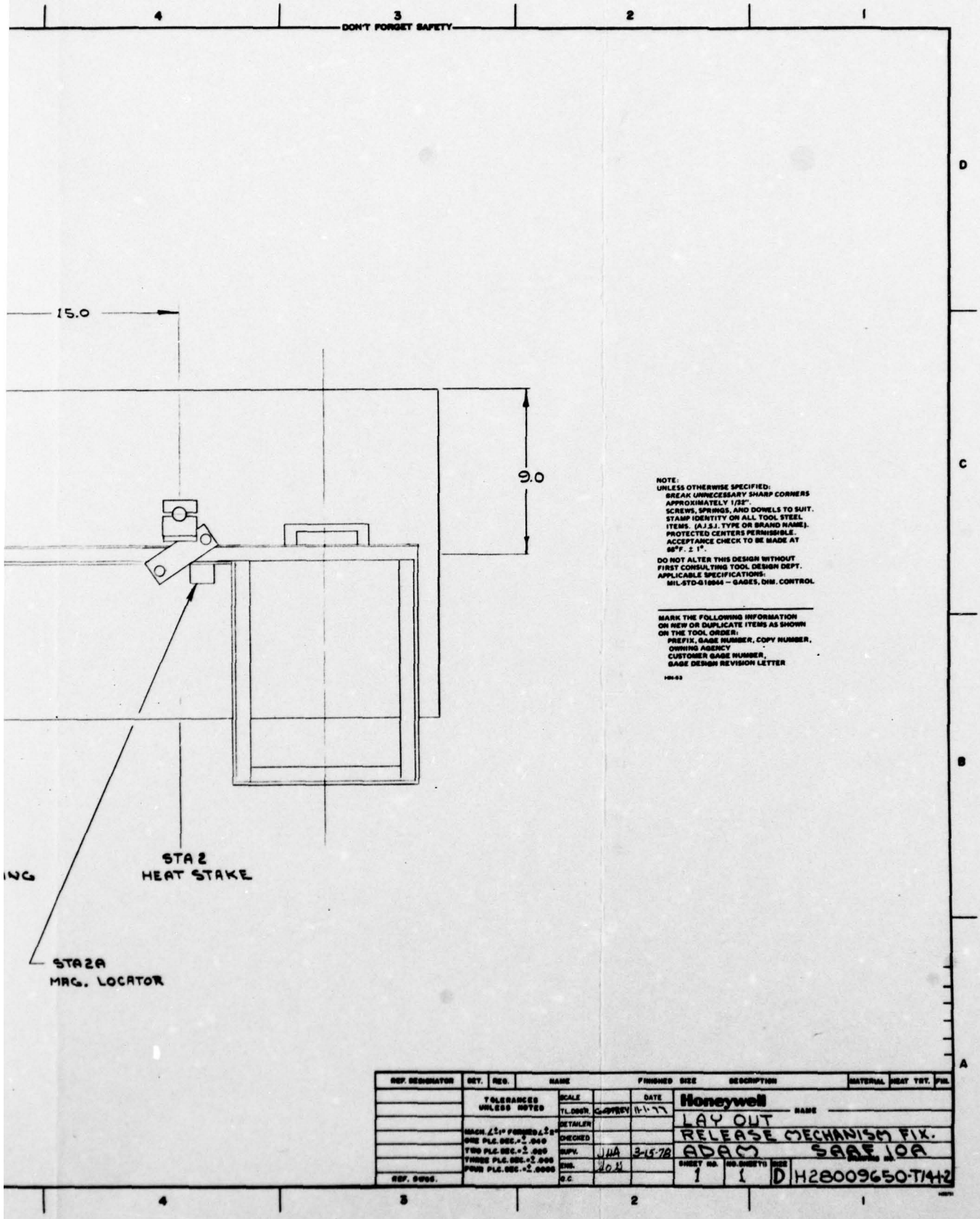


Figure B-6. Machine #10A Terminal Assembly



10A Terminal Assembly Fixture

2

Reverse side is blank

MACHINE #11
RELEASE MECHANISM AND CASE ASSEMBLY

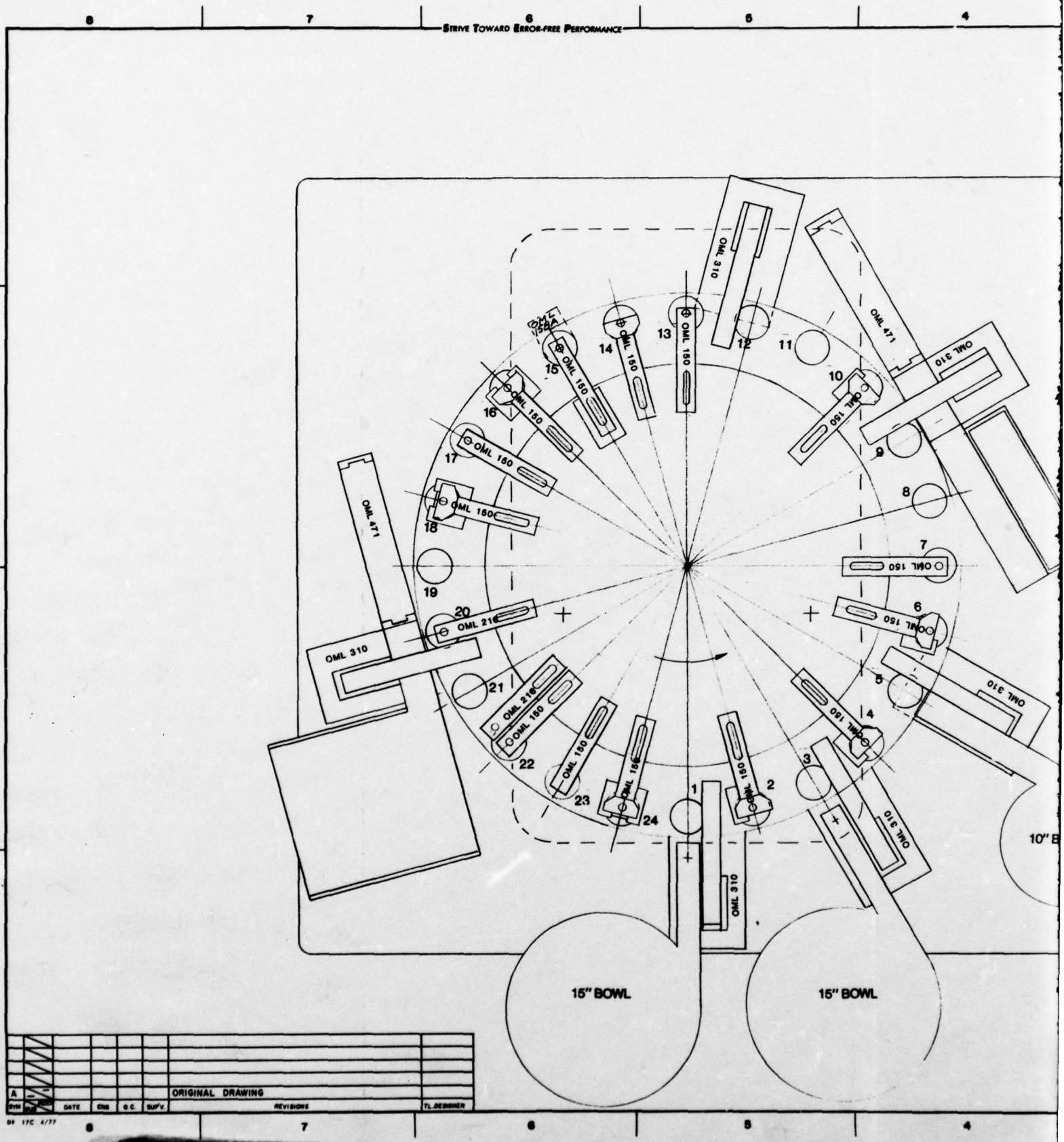
APPLICABLE PIECE PARTS

- Release Mechanism Assembly — Print #9292991
- Case Washer — Print #9292989
- Locking Ball — Print #9298581
- Sleeve — Print #9292988
- Sensor Case — Print #9292987

MACHINE OPERATIONS

This machine (Figure B-7) assembles the release mechanism assembly, case washer, locking balls, sleeve and sensor case. Crimping the sensor case onto the release mechanism along with the four locking balls maintains this assembly together. The small ball size adds to the complexity of this assembly. The sequence of operations is as follows:

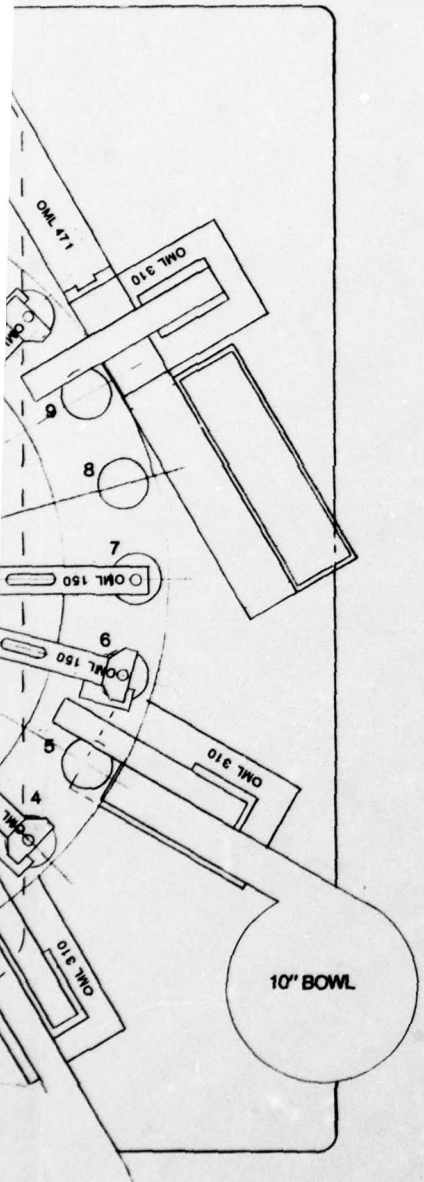
1. The sleeve is fed from a vibratory bowl onto the nest.
2. The sensor case is fed from a vibratory bowl onto the nest.
3. The case washer is fed from a vibratory bowl and positioned in the nest adjacent to the sleeve and sensor case.
4. The nest is now compounded allowing the washer and sensor case to drop approximately 1/2 inch lower than the sleeve. This allows for positioning of the locking balls in the sleeve at a later station.



7. Machine #11 Release Mechanism and Ca

4 | 3 DON'T FORGET SAFETY | 2 | 1

STA.	OPERATION	PART NO.
1	HOPPER ORIENT. METER & FEED SLEEVE	9292988
2	PROBE P & P	
3	HOPPER ORIENT. METER & FEED SENSOR CASE	9292987
4	PROBE P & P	
5	HOPPER FEED WASHER	9292989
6	PROBE P & P OF CASE & WASHER	
7	COMPOUND NEST	
8	IDLE	
9	MAG. FEED RELEASE MECH.	9292991
10	PROBE P & P	
11	IDLE	
12	VACUUM FEED (4) BALLS TO NEST RING	9298581
13	PROBE PRESENCE OF BALLS	
14	RADIALLY FEED BALLS	
15	RELEASE NEST COMPOUND. POSITION CASE WASHER	
16	PROBE PRECRIMP HEIGHT	
17	CRIMP SENSOR CASE (SUPPORT NEST)	
18	PROBE CRIMP	
19	IDLE	
20	EJECT TO MAGAZINE	9292986
21	IDLE	
22	REJECT TO CONTAINER	
23	EXERSIZE NEST ACTION, VACUUM NEST	
24	PROBE EMPTY NEST DEAD CAM NEST SUPPORTS	



OML 189 BASE

REF. DESIGNATOR	QTY.	REQ.	NAME	FINISHED SIZE	DESCRIPTION	MATERIAL	HEAT TRT.	FIN.
H28108567TH2								

TOLERANCES UNLESS NOTED
MACH. ±1/2° FORMED ±2°
ONE PLC. DEC. ±.040
TWO PLC. DEC. ±.020
THREE PLC. DEC. ±.005
FOUR PLC. DEC. ±.0050

SCALE	1/1	
TL. DSGN.	HOLM	12-21-77
DETAILER		
CHECKED		
SUPV.	JHA	4-18-78
ENG.	QAB	4-19-78
Q.C.		

Honeywell
NAME
TOP LAYOUT
SENSOR CASE & SLEEVE ASS'Y
XM74 GEMSS E.T.L. SAAF
SHEET NO. 1 | NO. SHEETS 1 | SIZE D
77-9610-AA

4 | 3 | 2 | 1

5. The release mechanism is fed from a magazine onto the sleeve with the correct orientation.

6. Four 0.040 diameter locking balls are fed by a vacuum pickup to a nest ring. This nest ring is compounded allowing the balls to run down four ramps into their correct position in the assembly.

7. With the four balls in position the nest is compounded again and the washer and case are adjacent to the sleeve and release mechanism. The balls are now contained in the assembly.

8. The assembly is permanently fixed together by crimping the sensor case.

9. After the crimping operation, the sensor case and sleeve assembly is ejected into a magazine.

MACHINE #12B
SENSOR CASE AND SPRING ASSEMBLY

APPLICABLE PIECE PARTS

- Release Mechanism & Case Assembly — Print #9292986
- Eject Spring — Print #9298578
- Booster Spring — Print #9292990
- Eyelet, Interface — Print #9292981

MACHINE OPERATIONS

This machine (Figure B-8) is required to assemble the release mechanism and case assembly (obtained from Machine #11) with the ejection spring, booster spring and interface eyelet. The two springs are temporarily held in compression with a retaining pin. This retaining pin is removed on the following assembly machine. The sequence of machine operations is as follows:

1. The sensor case and sleeve assembly is fed from a magazine onto the nest. This assembly is inverted in the process so the release mechanism is located at the bottom of the nest.

2. Before the first spring is inserted, the nest pins are exercised to ensure correct position of the sensor case in the nest. These nest pins are later used to contain the booster spring in compression.

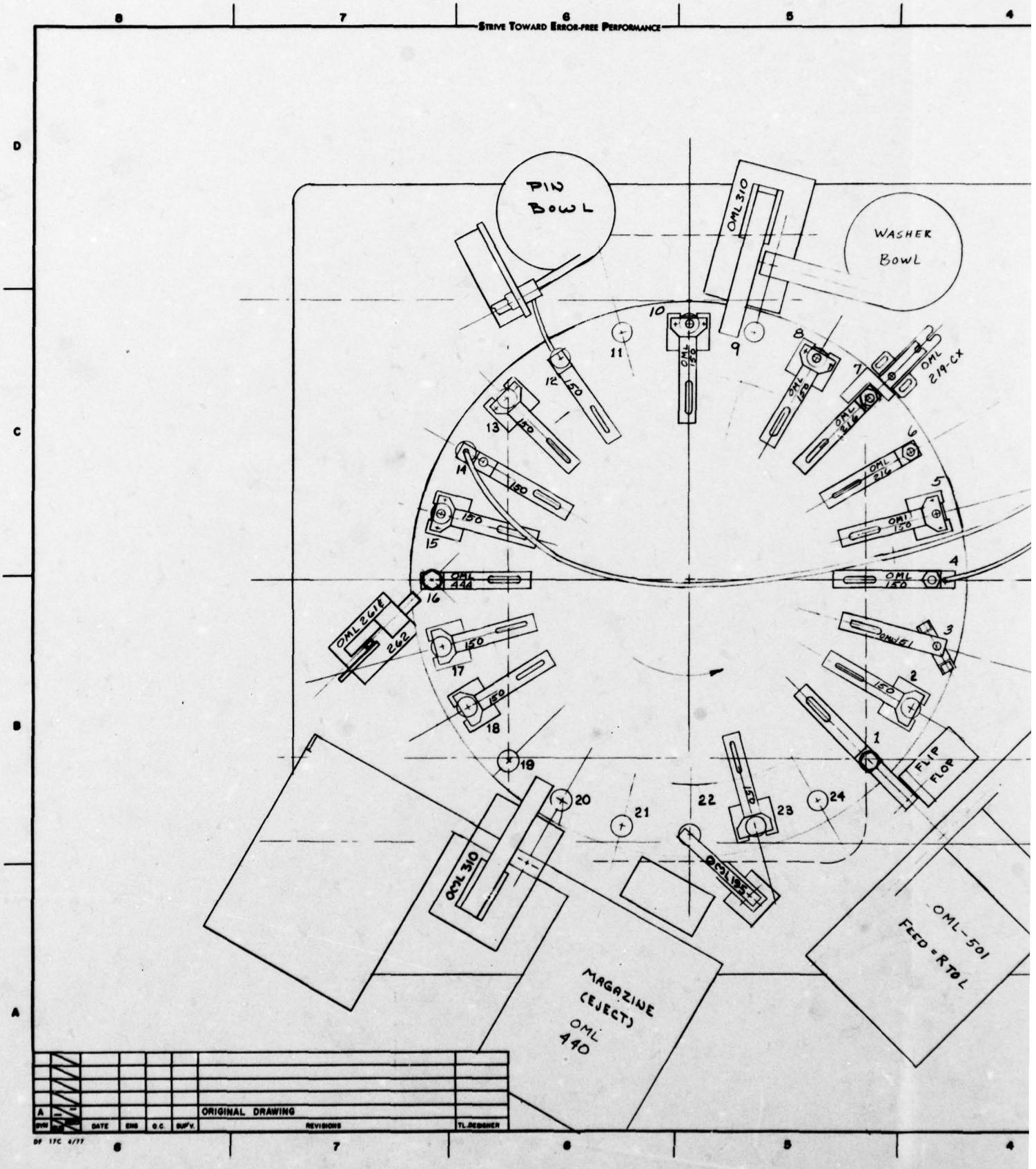
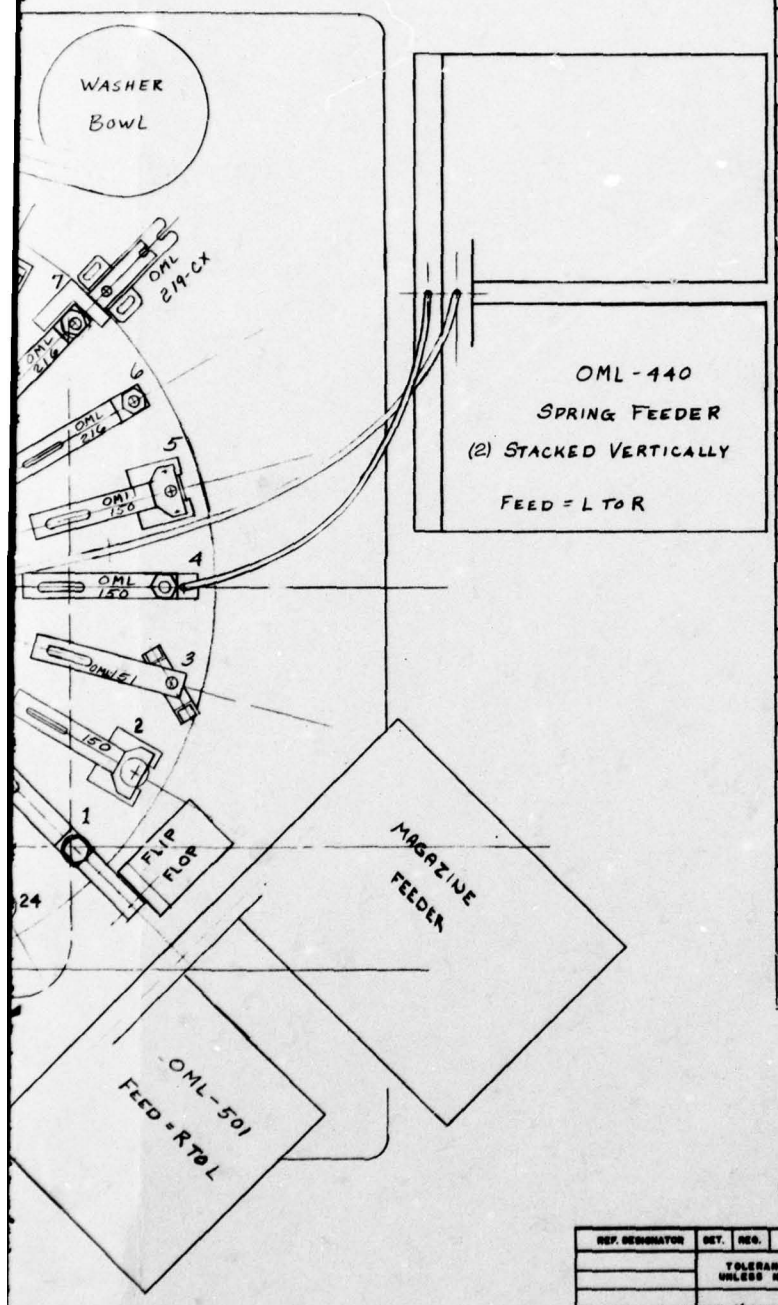


Figure B-8. Machine#12B Sensor Case and

DON'T FORGET SAFETY

STA.	OPERATION
1	MAG. FEED SENSOR CASE & SLEEVE ASSY.
2	PROBE PRESENCE , POSITION & FORM
3	EXERCISE NEST PINS
4	MAG. FEED BOOSTER SPRING
5	PROBE PRESENCE
6	PRE-POSITION SPRING
7	COMPRESS SPRING & CLOSE NEST
8	PROBE PRESENCE & POSITION
9	HOPPER FEED WASHER
10	PROBE PRESENCE
11	IDLE
12	HOPPER FEED RETAINING PIN
13	PROBE PRESENCE & POSITION
14	MAG. FEED EJECTION SPRING
15	PROBE PRESENCE
16	COMPRESS SPRING & INSERT RETAINING PIN
17	PROBE PRESENCE & POSITION OF PIN
18	PROBE PRESENCE OF SPRING
19	IDLE
20	EJECT TO MAGAZINE
21	IDLE
22	REJECT
23	PROBE EMPTY NEST
24	IDLE



REF. DESIGNATOR	QTY.	REQ.	NAME	FINISHED SIZE	DESCRIPTION	MATERIAL	HEAT TRT.	PNL.
			TOLERANCES UNLESS NOTED	SCALE 1/4 X	DATE	Honeywell		
				TL. DSGN. W.G.G.		NAME		
				DETAILER		TOP VIEW LAYOUT		
			MACH. ∠ ±1° FORMED ∠ ±2°	CHECKED		SENSOR CASE & SPRING ASSY.		
			ONE PLC. DEC. = ±.040	SUPV. JHH 9-26-73		XM74 GEMSS E.T.L. SAAF 12B		
			TWO PLC. DEC. = ±.020	ENG. G-B 4-21-73		PROJECT NO.		
			THREE PLC. DEC. = ±.005	Q.C.		SHEET NO. 1	NO. SHEETS 1	SIZE D
			FOUR PLC. DEC. = ±.0005			77-9610-AF		
REF. DWGS.								

12B Sensor Case and Spring Assembly

Reverse side is blank

3. After the nest pins are exercised, the booster spring is inserted, prepositioned, compressed and retained in the case by the nest pins.

4. The interface eyelet is fed from a vibratory bowl and positioned into the sensor case.

5. Now, a temporary retaining pin is fed to a V slot located on the top of the nest. This pin is now adjacent to the release mechanism and case assembly.

6. Next, the ejection spring is fed to the nest and compressed. The nest slides are retracted and the retaining pin is pushed into place.

7. The sensor case and spring assembly is ejected to a magazine which will feed into Machine #12.

MACHINE #12
SENSOR CASE & BOBBIN ASSEMBLY

APPLICABLE PIECE PARTS

- Cap — Print #9298579
- Ball Lock — Print #9298581
- Anchor — Print #9292980
- Bobbin Assembly — Print #9292982
- Sensor Case & Spring Assembly

MACHINE OPERATIONS

This machine (Figure B-9) is required to assemble the cap, anchor, bobbin assembly and locking balls into the sensor case and spring assembly. The sensor case and spring assembly is acquired from machine #12B and already contains the eyelet and ejector and booster springs. Once these piece parts are assembled, they are contained by crimping the sleeve and cap tabs. The sequence of machine operations is as follows:

1. The sensor case and spring assembly is fed into the nest.
2. The pin containing the springs within the case is removed and nest slides are used to maintain the springs in compression.
3. Two locking balls are fed and positioned into the assembly.
4. The bobbin assembly is now fed and positioned into the case.

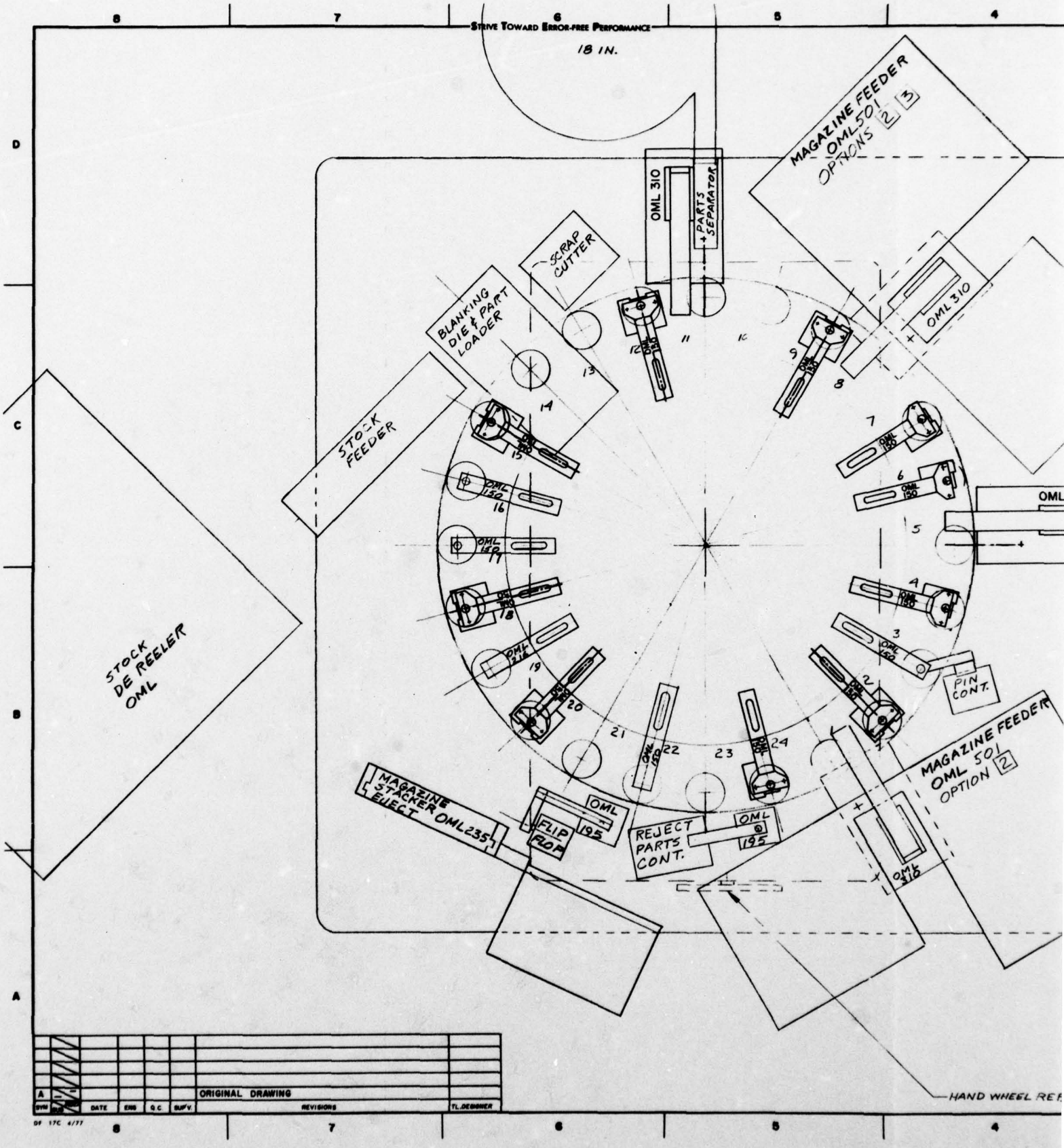
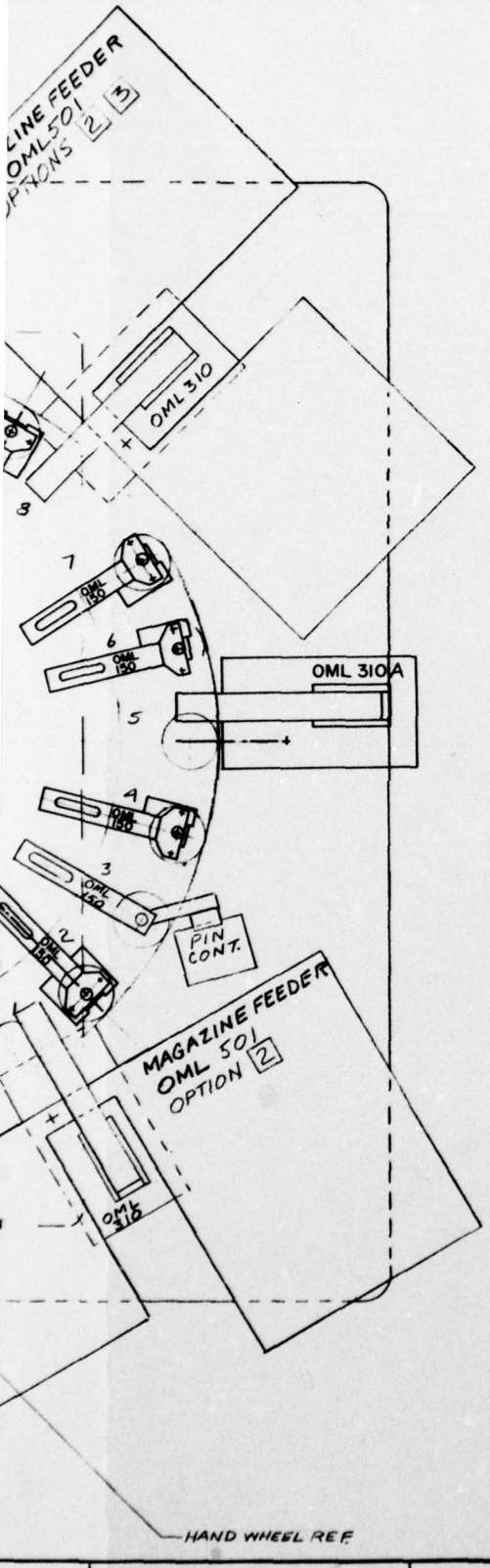


Figure B-9. Machine #12 Sensor Case and Bobb



DON'T FORGET SAFETY

STA NO	
1	MAG FEED CASE
2	PROBE P & P
3	REM. PIN. CLOSE NEST SLIDES
4	PROBE PIN REMOVED, RAISE NEST POST
5	VAC. FEED (2) BALLS
6	PROBE PRES. LOWER & RAISE NEST POST
7	PROBE BALLS LOCATION
8	MAG FEED BOBBIN
9	PROBE P & P
10	IDLE
11	FEED ANCHOR
12	PROBE P & P
13	IDLE
14	BLANK & FEED CAP
15	PROBE P & P
16	CLINCH SLEEVE TABS
17	CLINCH CAP TABS
18	PROBE HEIGHT
19	DRILL BOBBIN
20	PROBE DRILLED BOBBIN
21	EJECT (INVERT) TO MAG
22	IDLE (VACUUM MANIFOLD)
23	REJECT TO CONTAINER
24	VAC. & PROBE EMPTY NEST

REF. DESIGNATOR	QTY.	REQ.	NAME	FINISHED SIZE	DESCRIPTION	MATERIAL	HEAT TRT.	FIN.
			TOLERANCES UNLESS NOTED	SCALE	DATE	Honeywell		
				DRAWN HOLM	2-2-78			
				DETAILER		TOP LAYOUT		
				CHECKED		SENSOR CASE & BOBBIN ASS'Y		
				SUPV. JHA	4-28-78	XM74 GEMSS ETL	SAAF# 12	
				ENG. DJS	4-21-78	SHEET NO. 1	NO. SHEETS 1	SIZE D	77-9610-AB
REF. SPECS.				Q.C.				

12 Sensor Case and Bobbin Assembly

Reverse side is blank

2

5. The anchor is fed and positioned on top of the bobbin assembly.

6. Now the cap is blanked from strip stock and positioned on top of the anchor.

7. The sleeve tabs are crimped to hold the assembly together just after the nest slides are retracted.

8. The cap tabs are crimped to lock the assembly together.

9. Now the bobbin assembly within the case is drilled separating the weighted and sensor wire end of the bobbin assembly.

10. Finally this sensor case and bobbin is ejected from the machine into a magazine.

MACHINE #13
SENSOR AND BREAKWIRE ASSEMBLY

APPLICABLE PIECE PARTS

• Sensor Case and Bobbin Assembly	Print #9292976
• Wire, Mag., Elect	Print #9298576
• Ring, Retaining	Print #9298577
• Cover Post	Print #9298575

MACHINE OPERATIONS

This machine (Figure B-10) is designed to weld the breakwire to the two breakwire terminals. Several operations precede and follow the welding station. This is for preparatory purposes and continuity checks. The two other piece parts involved in this assembly machine are the retaining ring and plastic post cover. The sequence of machine operations is as follows:

1. First, the sensor case and bobbin assembly are fed from a magazine to the nest.

2. The breakwire is fed from a remote station and the insulation is burned off. Then this section of wire is positioned onto the breakwire terminals. To maintain control of the breakwire, jaws on the nest are activated.

3. A retaining ring and cover post are fed onto the release mechanism and positioned. This helps to further capture the breakwire.

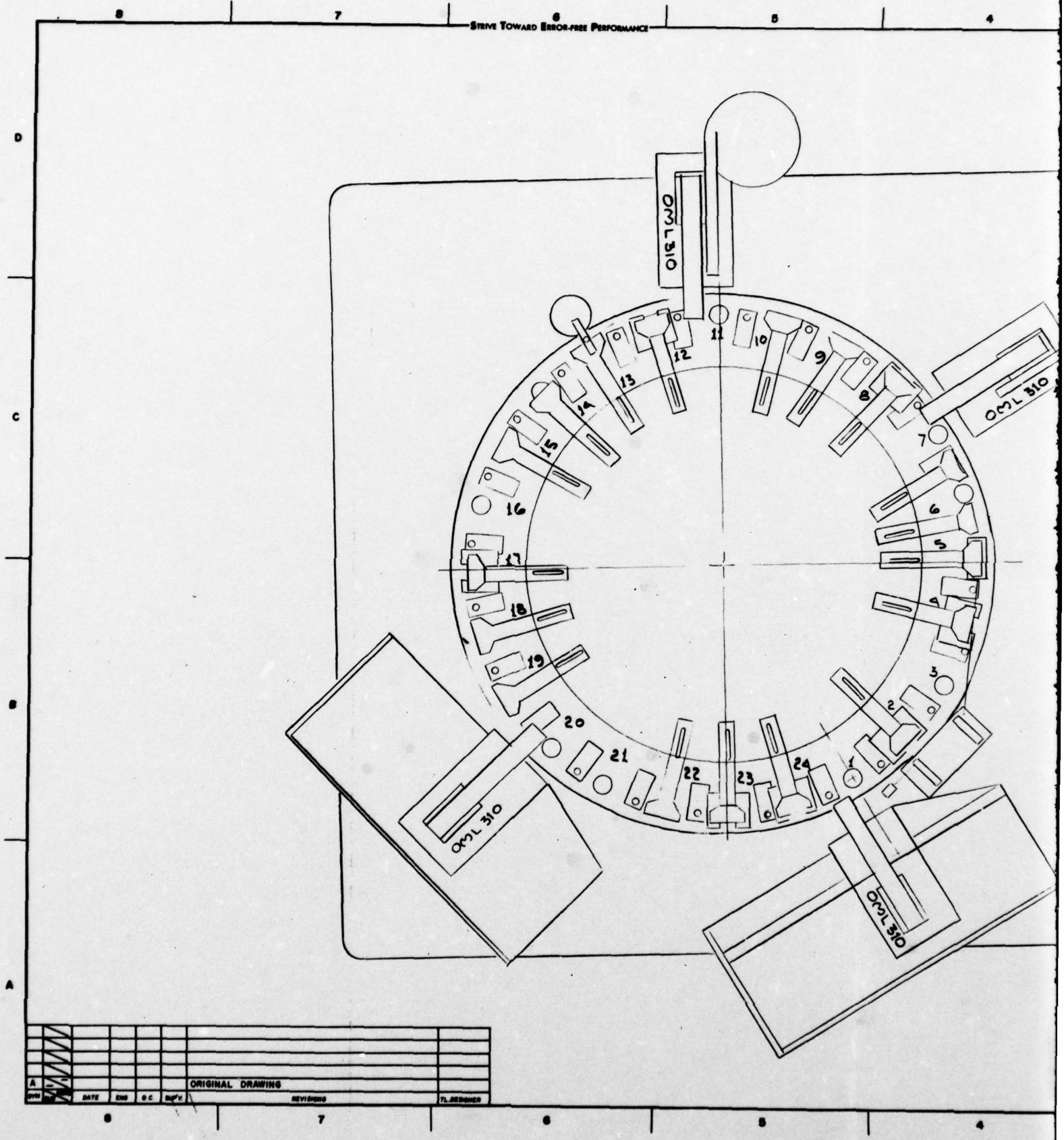
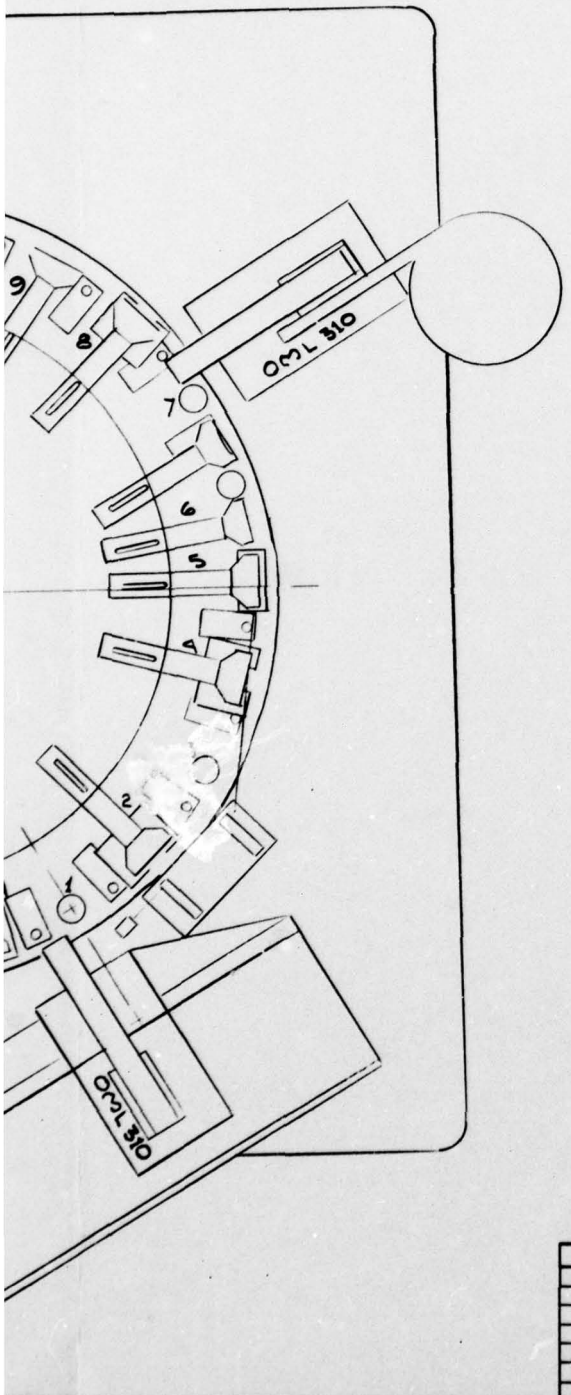


Figure B-10. Machine #13 Sensor and Breakwire

DON'T FORGET SAFETY



1	MAGAZINE FEED SENSOR CASE & BOBBIN ASSY
2	PROBE PRESENCE & POSITION
3	POSITION FEED & BURNOFF INSULATION
4	PROBE PRESENCE
5	POSITION BREAKWIRE
6	IDLE
7	HOPPER ORIENT METER & FEED RETAINING RING
8	PROBE PRESENCE & POSITION
9	FINAL DRILL BOBBIN
10	PROBE HOLE DEPTH
11	HOPPER ORIENT METER & FEED COVER POST
12	PROBE PRESENCE & POSITION
13	FLUX STATION
14	WELD
15	WELD
16	CUT BREAKWIRE
17	PROBE CONTINUITY
18	TRIM WIRES
19	PROBE CONTINUITY
20	EJECT TO STICK MAGAZINE
21	IDLE
22	AIR BLAST &VACUUM
23	REJECT TO CONTAINER
24	PROBE EMPTY NEST & AIR BLAST

REF. DESIGNATOR	QUT.	REQ.	NAME	FINISHED SIZE	DESCRIPTION	MATERIAL	HEAT TRT.	PUR.
			TOLERANCES UNLESS NOTED	SCALE	DATE	Honeywell		
				TL.000%	W.G.G.			
				DETAILER		TOP VIEW LAYOUT		
				CHECKED		SENSOR & BREAKWIRE ASSY		
				SUPV.	4-28-78	XM 74 GEMSS E.T.L.	S.A.A.F. 13	
				ENG.	4-21-78	SHEET NO. 1	NO. SHEETS 1	SIZE D
REF. DWGS.				D.C.				

77-9610-AC

#13 Sensor and Breakwire Assembly

Reverse side is blank

2

4. The bobbin assembly goes through a final drilling operation to clear any excess material in the assembly.

5. Now flux is applied and the breakwire is welded to each terminal.

6. The breakwire is cut and trimmed. A continuity probe is used to ensure a complete weld.

7. Finally the sensor and breakwire assembly is ejected to a magazine.

MACHINE #13A
SENSOR EPOXY FIXTURE

APPLICABLE PIECE PARTS

- Tripline Sensor, Extend Range Print #9292972

MACHINE OPERATIONS

This machine (Figure B-11) is required to apply epoxy to the tripline sensor following the application of two (2) No. 26 Gage Lead Wires (hand line operation). This epoxy serves to protect the electrical connections completed on Machine #13. The fixture utilizes the magazines containing the tripline sensors as its nest. The sequence of machine operations is as follows:

1. The magazines containing the tripline sensors are indexed through the fixture.
2. Five separate stations apply epoxy at selected locations onto the release mechanism which combine to form one continuous epoxy coating to end of sensor.
3. Following the application of epoxy the loaded magazines are cured in an oven for a period of time.

3.2.2 Physical Characteristics --

Production Area:

a. The estimated weight of the Honeywell Standard Type 189 Base tooled is 9500 pounds. The space required for the typical

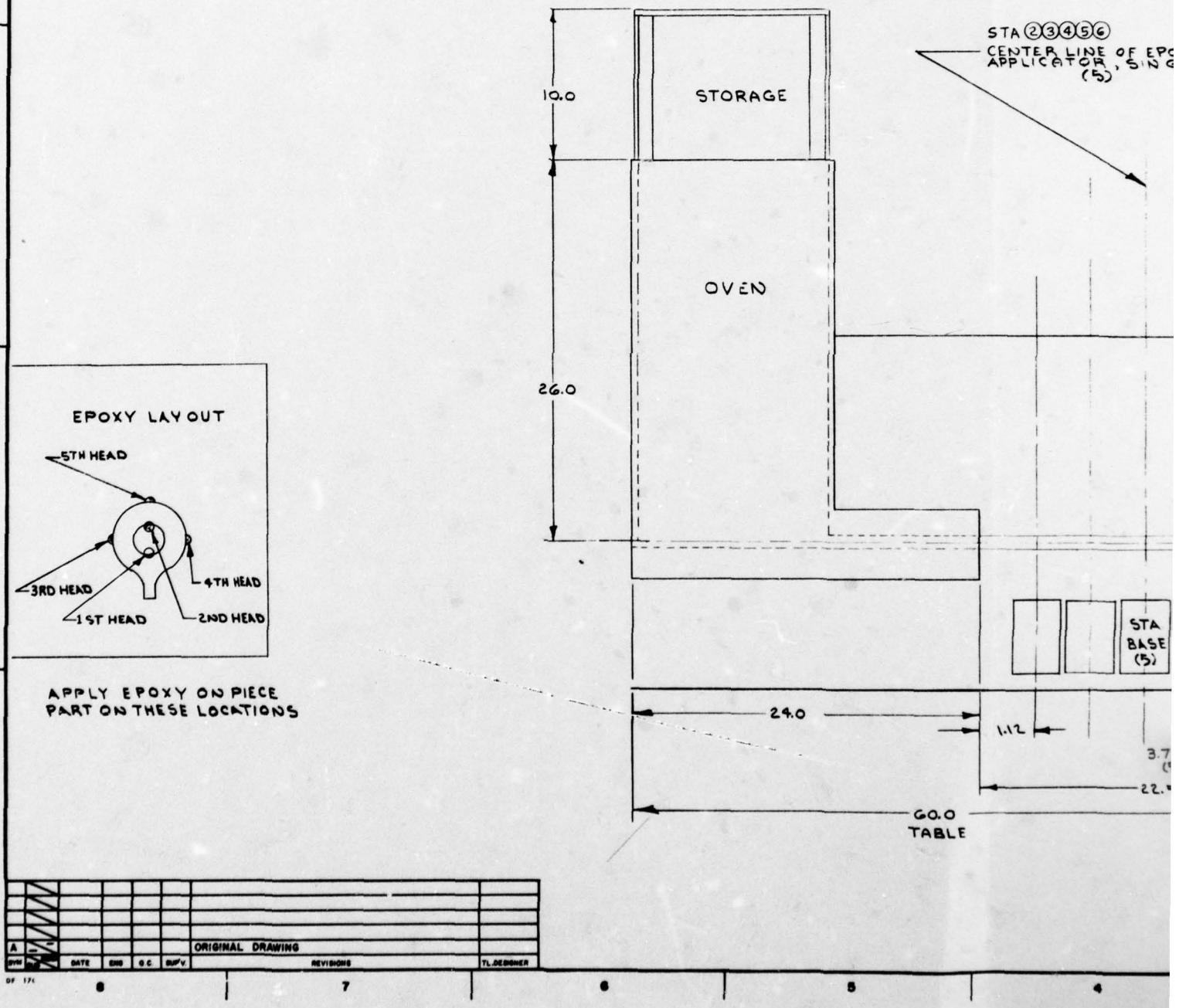
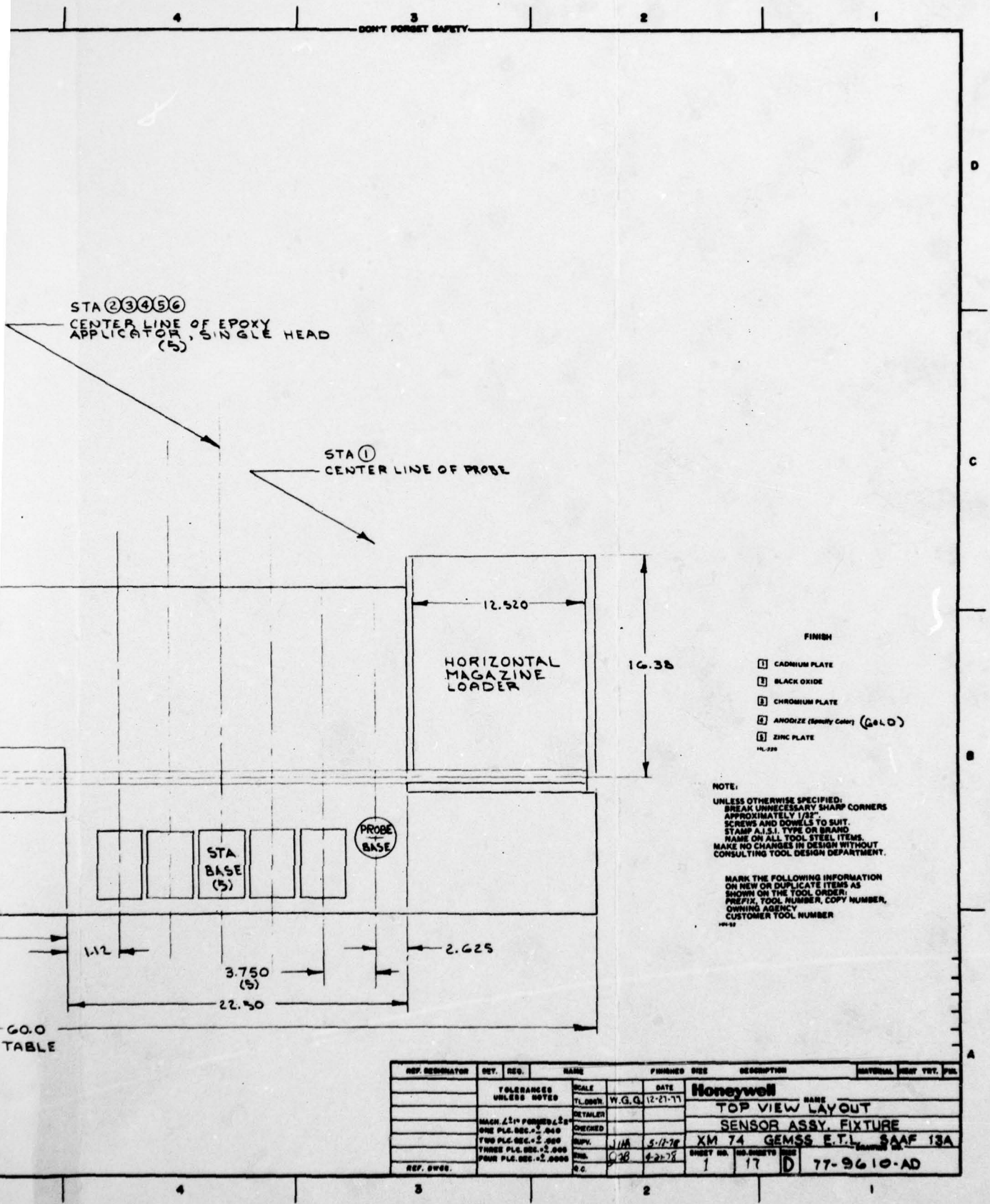


Figure B-11. Machine #13A Sensor Epoxy



hine #13A Sensor Epoxy Fixture

Reverse side is blank

2

SAAF is 400 square feet of floor space (20 ft. x 20 ft. square). This area will support parts and assemblies. The need for aisles and cart storage space is not included in the 400 square feet for the SAAF.

b. The space required for a typical spring winder (there are two on the E.T.L. Sensor), including stress relief ovens (two), would be 625 square feet of floor space. This area would support the carts used to load and store the completed springs, and to deliver the springs to SAAF 12B.

c. The space required for an ultrasonic degreaser for cleaning of some parts and especially for cleaning SAAF #11 Nest would be 25 square feet (5 ft. x 5 ft. square).

d. The space required for mixing epoxy for SAAF #13 would be 100 square feet (10 ft. x 10 ft. square). This area would require a special exhaust system to the outside of the building.

e. The space required for sensor lot acceptance testing would be 600 square feet (60 ft. long x 10 ft. wide). This would have to be a clear area 20 ft. high at mid-point in the length of the test area.

f. Allow 10% of total for aisles, break area and foreman's office.

Production Area Required:

a. 400 sq. ft. x 10 machines	4000 sq. ft.
b. Spring winding area	625 sq. ft.
c. Ultrasonic degreaser	25 sq. ft.

d. Epoxy mixing area		100 sq. ft.
e. Sensor LAT area		600 sq. ft.
	Subtotal	5350 sq. ft.
f. 5350 x 10%		
	Grand total	5885 sq. ft.

Factory floor plan layouts for the area in Bldg. 103, Twin Cities Army Ammunition Plant, which has been assigned for assembly of the XM74 GEMSS Sensor are shown in Exhibit A. This requirement is shown in two phases: (1) The initial production facility incorporating only one each of the required machines and (2) the area required with an expansion to meet the PEP study requirement of 200,000 Sensors/month on a 1:8:5 shift basis.

g. There are no security requirements with the SAAF or the E.T.L. Sensor with regard to the manufacturing area.

h. There are two areas where health considerations must be addressed, and are listed in Subparagraph "d" above. The out-gassing of the epoxy must be exhausted outside the work area (building) immediately. The epoxy is dispensed on Machine 13A so it must be equated with the exhaust to remove outgas from the epoxy.

The E.T.L. SAAF will meet all OSHA requirements prior to their installation on the E.T.L. production floor.

3.2.3 Reliability -- The reliability of each machine in the GEMSS XM74 Extended Sensor production line will have as a design goal a minimum mean-time-between failure (MTBF) of 8.5 hours. A failure is defined as any unscheduled machine stoppage during a scheduled production period which requires repair maintenance personnel action due to breakage or severe misalignment (i.e., malfunction) of any machine subassembly or component.

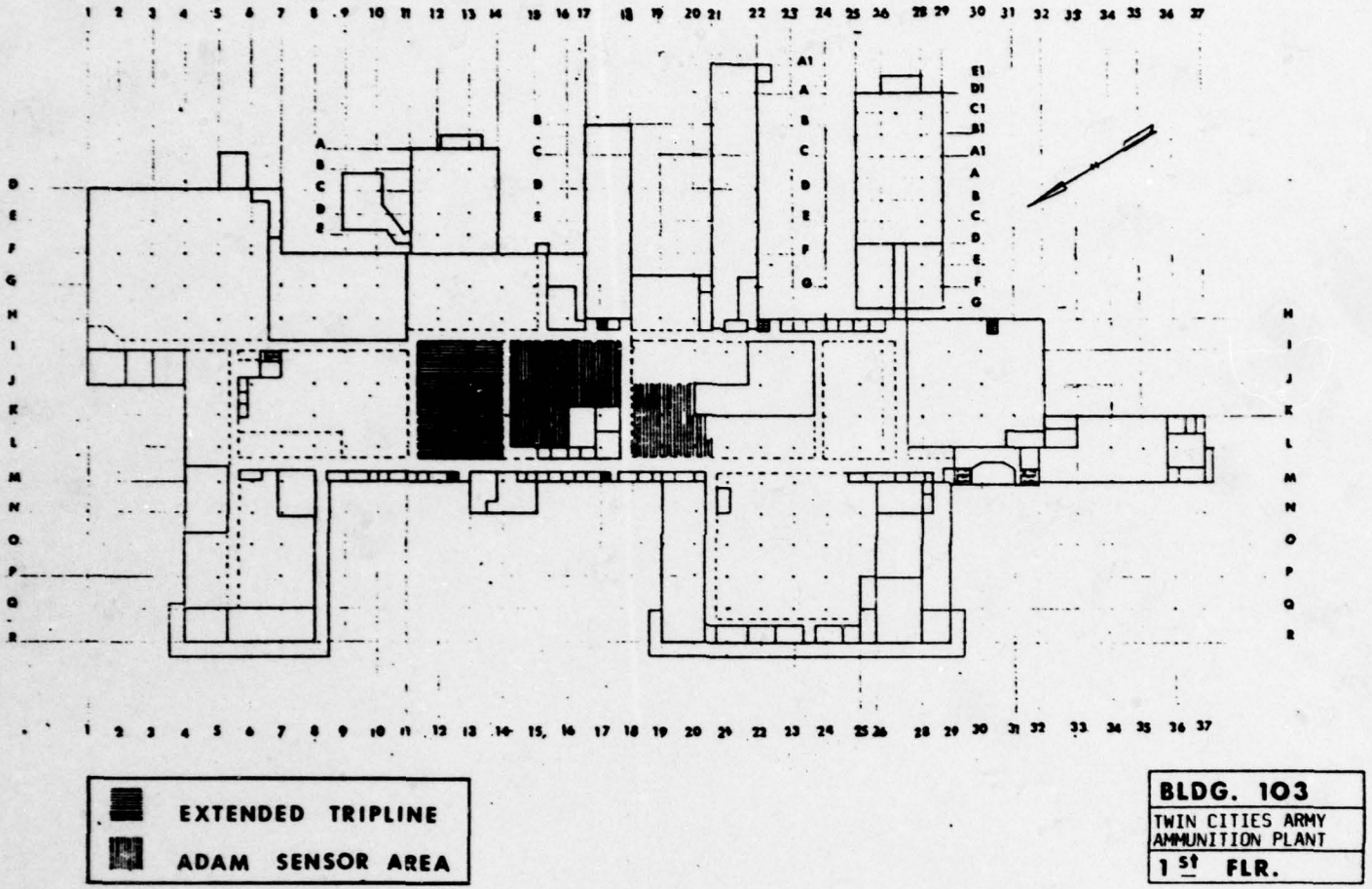
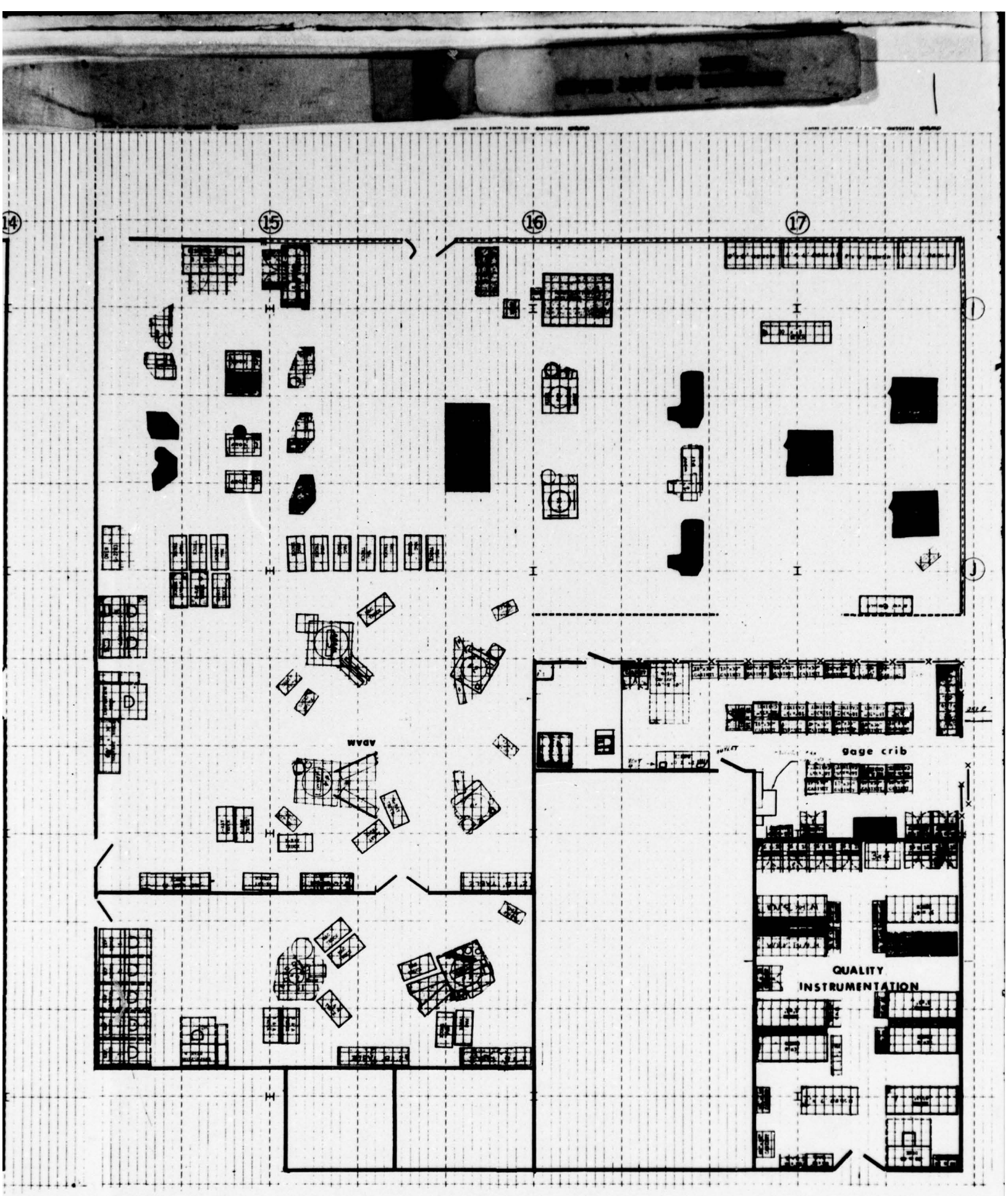


Exhibit A

Extended Tripline and ADAM Sensor Area


14
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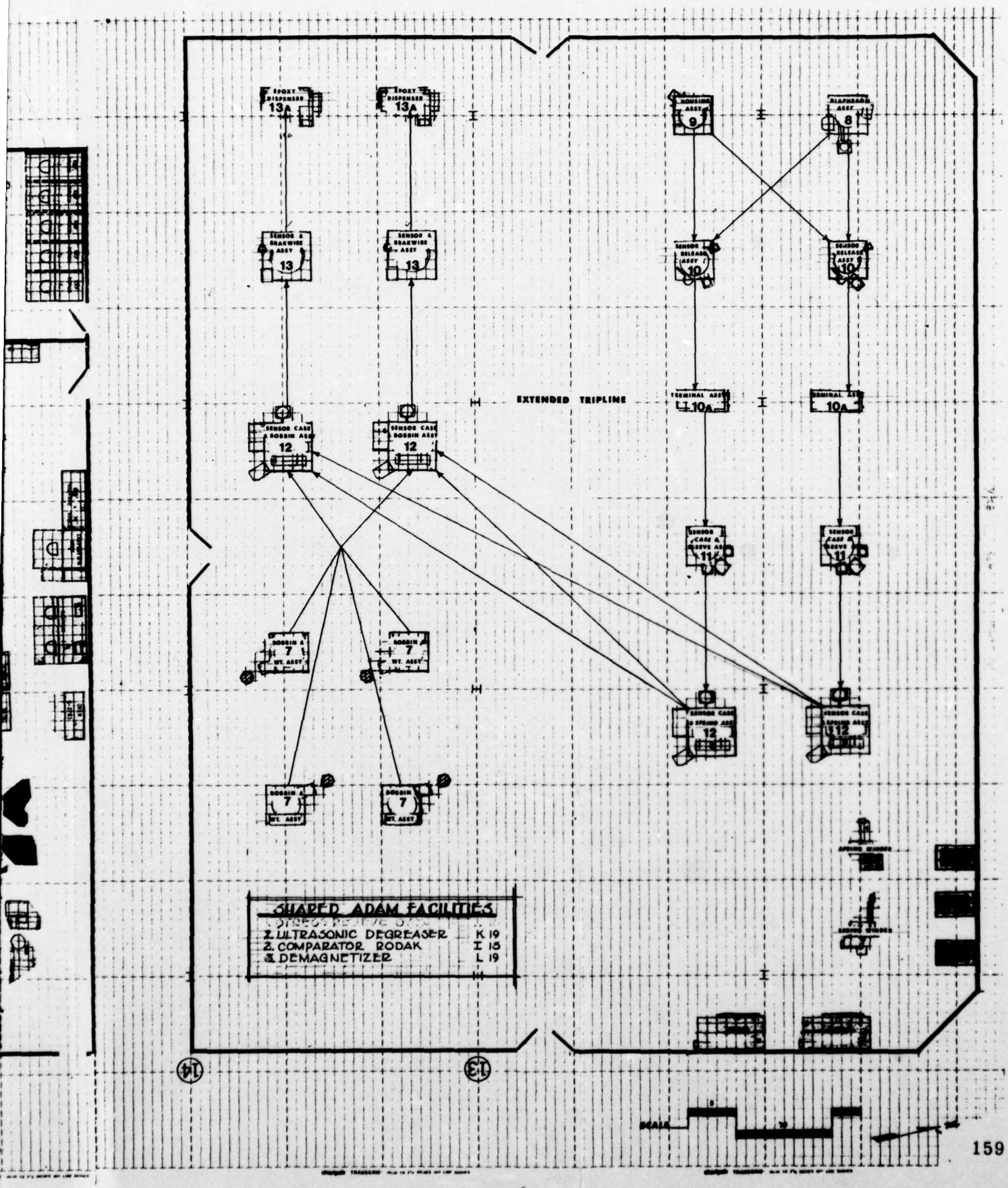
QUALITY
INSTRUMENTATION



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The time the machine runs is the production time associated with machine cycling, but not including any cycling during repairs or other cycling during which good product could not be produced. During the machine performance demonstrations and qualification testing, the number of failures and the production time will be collected as needed to calculate the machine mean-time-between-failure so that reliability growth can be analyzed.

3.2.4 Maintainability -- The maintainability of each machine used in the GEMSS Extended Tripline Sensor production line will have as a design goal a mean-time-to-repair (MTTR) of 1.75 hours. To achieve this goal, the machines will be designed to comply with the following:

a. Modularization -- The machines shall be designed to make maximum use of modularized subassemblies for ease of maintenance and to reduce the number and type of repair parts and assemblies required to support maintenance.

b. Accessibility -- Maximum use will be made of design techniques that will provide ready accessibility for replacement or servicing.

c. Interchangeability -- Components will be interchangeable without requirements to calibrate or adjust at time of replacement.

d. Maintenance Periods -- The system will be designed to that preventive maintenance is required only in off-production hours.

All machines are analyzed for MTTR using the definition of failure presented in Paragraph 3.2.3. The repair time will include preparation time, fault location time, fault correction time, adjustment/calibration time and checkout time. If two or more repair personnel are involved, only elapsed time

will be measured. However, the number, skills, and elapsed time for each repair person shall be recorded.

During the machine performance demonstrations and qualification testing, the number, type of failure, and the time to repair will be collected so that machine maintainability characteristics can be analyzed.

3.2.5 Availability -- The machines used in the GEMSS XM74 Extended Tripline Sensor production line shall be designed to minimize the downtime (MTTR) and to maximize the uptime (MTBF) for each machine. The machines shall be designed to have a minimum inherent availability of 85 percent. The inherent availability is defined as:

$$\text{Availability} = \frac{\text{MTBF}}{\text{MTBF} + \text{MTTR}} \times 100\%$$

Where MTBF = Mean Time Between Failures
MTTR = Mean Time to Repair

3.2.6 Environmental Conditions

a. Storage -- The SAAF equipment metal surfaces shall be protected during storage with a high grade preservative oil/grease. It shall further be covered with a plastic sheet pulled tightly to reduce openings around the fixture. All moisture shall be removed from the compressed air system. The electrical power shall be disconnected by removal of the fuzes. The SAAF number shall be affixed to the outside surfaces of the plastic shield, together with date of storage and next inspection scheduled date. Storage temperature recommended 40°F to 90°F in low humidity area.

b. Shipment -- The SAAF shall be loaded on a special built shipping platform which will support the Base Machine and provide bracing for all

arms which may extend beyond the SAAF table. The Electrical Control Box shall be braced as required to prevent vibration in shipping. The Upper Tooling Plate shall be in the down position during all movement of the SAAF's. Long magazine feeding stations (feed in or feed out) may be secured to the shipping platform. The SAAF shall further be protected by a wood frame plastic covered "Green House" construction to protect from water and dirt during shipment. The SAAF shall be protected from temperatures below 40°F. The mode of transportation recommended is the "Air Ride" offered by National Moving Concerns. Excessive shock and vibrations may result in damaged electrical systems as well as out of line conditions on metal parts.

c. Operation -- The SAAF equipment must be kept clean and well lubricated during normal operations. The build up of moisture in the Air System must be periodically drained. All cam followers and oil reservoirs must be serviced on a regular monthly schedule.

d. Environment -- The E.T.L. SAAF's have no effect on the natural environment except for SAAF 13A which dispenses epoxy onto the sensor. The epoxy outgassing is removed from the SAAF area by a special exhaust system. The mixing of the outgassing with the outside air has no effect on the environment.

3.2.7 Transportability -- Transporting assembly machines must be conducted with the care normally exercised in moving machinery. Moving must be by experienced personnel using proper equipment and safety precautions. There are no abnormal requirements for transporting.

3.3 Design and Construction

Contractor's background in assembly machine production must show a consistently high accomplishment on machine efficiency and reliability. All acceptable

industrial standards followed to maintain the quality in the design and construction of each machine. Military standards are to be followed when applicable.

3.3.1 Material, Process and Parts -- The materials used in standardized components are materials which lend themselves to the particular application. All castings are stress relieved to obtain maximum life and stability. All critical areas on machine bases and tooling are either painted, anodized or plated to provide a protective finish and add aesthetic value to the machine. Standardized components are selected on the basis of their particular application. The components to be of a correct and proportioned size so as not to approach their practical fatigue life. All applicable industrial standards are to be followed.

3.3.2 Tooling -- All special tooling is designed to meet the specific requirements listed in paragraphs 3.2.3, 3.2.4 and 3.2.5 and acceptable industrial standards.

3.3.3 Name Plates and Marking -- There is no general criteria used for identification and markings on electrical and pneumatic lines and controls. Identification here is only used when necessary. Lines are identified whenever hydraulic or water lines are concerned to avoid confusion in the machine system.

3.3.4 Interchangeability -- Standardized tooling and castings should be utilized in the design and assembly of assembly machines. Some of the standardized features include: probes, parts feeding mechanisms, magazine feeders, work stations, etc. This major emphasis on standardization throughout reduces the number and type of repairs required to support maintenance and maintain interchangeability at a maximum.

3.3.5 Safety -- Through the use of good design and the proper selection of material, machine safety shall be in conformance with the intent, and general interpretation of the following safety publications and codes:

a. AMCR385-100, AMC Safety Manual

b. AR40-5, Health and Environment

c. MIL-STD-882A, System Safety Program Requirements

d. Occupational Safety and Health Act (OSHA)

e. National Electric Code for Hazardous Operations.

The Safety Engineering effort will be coordinated with RAM and HFE efforts to establish an integrated program. A safety review of each machine shall be conducted to determine compliance with the above-listed publications.

3.3.6 Human Performance/Human Engineering -- Each machine in the GEMSS XM74 Extended Tripline Sensor production line shall be in conformance with the intent and general interpretation of the following documents:

a. MIL-STD-1472B -- Human Engineering Design Criteria for Military Systems Equipment and Facilities.

b. MIL-HDBK-759 -- Military Standardization Handbook, Human Factors Engineering Design for Army Material.

A human factors review of each machine shall be conducted prior to release of the machine for use in the normal production environment to determine compliance with the above-listed documents.

3.3.7 Standards of Manufacture -- The standards of manufacture for Special Automatic Assembly Machines used in the assembly of the XM74 GEMSS

Extended Tripline Sensor will be in accordance with the items described on the following specification sheets for automatic assembly machines (Ref: Exhibit B). These are general specifications. Detailed specifications will be generated prior to actual machine build and will be recorded on a form as shown in Exhibit C.

3.4 Major Component Characteristics

Each component listed in 3.1.1 is self explanatory for its performance and physical characteristics. Your attention is invited to the attached booklet entitled, Automation Standard Equipment, for additional information.

4.0 QUALITY ASSURANCE PROVISIONS

The performance and physical requirements of the GEMSS Extended Tripline Sensor Special Automatic Assembly Line shall be demonstrated on each Special Automatic Assembly Fixture (SAAF).

4.1 General

Development Contractor personnel shall witness the tests/verifications of each SAAF in the Automated Assembly Laboratory. SAAF completeness and physical requirements shall be verified prior to the demonstration test. SAAF performance shall be verified during the demonstration test. The conformance of the Extended Tripline Sensor assemblies to QAP-GEMSS-1, shall be verified during and following each demonstration test.

EXHIBIT A

HONEYWELL SPECIFICATION SHEET AUTOMATIC ASSEMBLY MACHINE PRELIMINARY	REVISION ORIGINAL
	DATE 31 AUGUST 1978
	NAME R. FAIRCHILD
MACHINE: XM74 GEMSS ERT SENSOR	CC: M.L. J. BUDNICKI
PART OP: GENERAL SPECIFICATION ALL MACHINES	M.L. P. VAN BROCKLIN
TOOL NO:	QUAL C. FLAMMING/R. KEEFE
ACCEPTANCE: 1 HR	P.E. G. ADAMS
ITEM	

1. Machine Counters

   a. Cycle counter - 7 digit total cycle quantity, non-resetable.
   b. Good assemblies - 6 digit, resetable.
   c. 6 digit total cycle resetable.
   d. Mount counter as low as possible on cabinet.

2. Identification Areas

   a. All nest locations with stamped number.
   b. Air Gauges and valve marked with recommended settings.
   c. Limit switches noted Normally Open (NO) or Normally Closed (NC).
   d. Station numbers permanently affixed.

3. Machine Controls

   a. One remote jog card - female receptable.
   b. Index start/stop button on each end of each machine within easy reach of operator unless noted otherwise.
   c. All presence and position probes stop up unless noted.
   d. All orient motors stop with cycle stop.
   e. Probes with count feature will be adjustable - one, three, or stop up.
   f. All feeder bowls and vibratory tracks to stop with main motor start/stop switch.
   g. Individual air pressure regulators for each air operated work station when required for critical adjustments.
   h. Lighted numbers to be displayed for probe stations, jam switches, etc.
   i. Explanation of all lighted numbers to be displayed on two sides of electrical cabinet.
   j. All open air blow lines to stop with cycle start/stop switch.

4. Safety

   a. The machine must meet Honeywell requirements for safety.
   b. Must meet OSHA requirement for pinch points and notes.
   c. Guards around explosive handling stations shall fit contour of station and have door to allow easy accessibility.
   d. Noise-muffle all air valves and Venturi vacuums, avoid air assist on eject.

5. Tool Inspection - Machine Check List

   a. Proper assemble, alignment and security of machine components.
   b. Dimensional and positional variations of nests and other selected components.
   c. Proper function of machine components.
   d. All cams to be keyed.
   e. Critical nest dimensions to be identified by Production Engineer must be inspected and verified by Tool Inspection prior to assembly.

EXHIBIT B

HONEYWELL SPECIFICATION SHEET AUTOMATIC ASSEMBLY MACHINE PRELIMINARY	REVISION ORIGINAL
	DATE 31 AUGUST 1978
	NAME R. FAIRCHILD
MACHINE: XM74 GEMSS ERT SENSOR	CC: M.L. J. BUDNICKI
PART OP: GENERAL SPECIFICATIONS ALL MACHINES	M.L. P. VAN BROCKLIN
TOOL NO:	QUAL R. KEEFE
ACCEPTANCE: 1 HR	P.E. G. ADAMS
ITEM:	

6. General Acceptance

   a. Complete design package of each machine to include electrical schematic, and program documentation. All cam layouts and charts.
   b. Machines will be provided with a tool cabinet with setup masters, cam templates and all special tools.
   c. A critical spare parts list will be included with each machine, listing parts that should be kept in stock to preclude production delays. Drawing(s) shall be included if needed to describe the part(s).
   d. An Operation and Maintenance Manual shall be supplied with each machine.

7. Acceptance Demonstrations

   a. Machine Base - Each machine base will be run-in for a period of 24 hours minimum at full cycle to demonstrate base reliability prior to machine assembly.
   b. Tooled Machine Without Parts - Each completely tooled machine will be run less parts at full cycle rate for a period of 24 hours minimum to demonstrate proper machine fabrication.
   c. Completed Machine With Parts - Each machine will be accepted for production of sensor qualification build after demonstrating a minimum of 30 percent of estimated production rate (i.e., a quantity of "acceptable units" equal to one hour estimated production rate must be fabricated in 3.33 hours (maximum).
   d. Machine caused defects shall be no greater than XX% of the acceptable units. Acceptable units include "non-machine caused" defective units. The machine base, feed bowls, and other components will run at the specified cycle rate during this acceptance. The operator loading during this run will be the same as the anticipated operator loading for the initial product build. An operator can be Machine Lab Technician or Tool Maker.

8. General Tool Station Features

   a. Eject stations to magazines shall have parts jam stop switches and have fail safe concepts.
   b. Magazine stackers shall have a positive method of magazine alignment.
   c. Inspection stations and probes will have setup lights.
   d. Presence and position probes will normally follow each work and assembly station according to standard practice, unless otherwise noted.
   e. Avoid the use of air for eject, reject, and feeding of parts whenever practical.
   f. Feeder bowls to have slots or holes for escape of dirt, foreign material, short parts, etc.

EXHIBIT B

HONEYWELL	SPECIFICATION SHEET AUTOMATIC ASSEMBLY MACHINE PRELIMINARY	REVISION	ORIGINAL
		DATE	31 AUGUST 1978
		NAME	R. FAIRCHILD
MACHINE:	XM74 GEMSS ERT SENSOR	CC: M.L.	J. BUDNICKI
PART OP:	GENERAL SPECIFICATION ALL MACHINES	M.L.	P. VAN BROCKLIN
TOOL NO:	1 HR	QUAL	R. KEEFE
ACCEPTANCE:		P.E.	G. ADAMS
ITEM			

9. Extra Machine Base Features

Each machine shall have a variable speed motor.

10. Approvals Required

a. Production Engineering approval is required on machine concepts, dial layouts, nests designs, inspection station designs and magazine designs and acceptance demonstrations.

b. Production Engineering approvals are required on preliminary inspection station concepts and final inspection station designs before starting fabrication.

c. Quality Engineering approvals on qualified inspection stations.

11. Magazine Requirements

Each machine package shall include a sifficient quantity of magazines to hold 2,000 parts or assemblies.

Exhibit C

SPECIFICATION SHEET
AUTOMATIC ASSEMBLY MACHINE PROGRAM

MACHINE	BASE	REVISION / DATE
PART NUMBER	OPERATION NUMBER	ORIGINATOR
MACHINE CONTROLS	DRIVE	CC
ACCEPTANCE - C. PM	QUANTITY AND TIME	SCRAP %

STATION REQUIREMENTS

1. PARTS ASSEMBLED & HOW RECEIVED

2. WORK STATIONS

3. MEASUREMENTS ITEMS	TOLERANCE REQUIRED	STOP	MASTERS REJ HIGH	MASTERS ACC HIGH	MASTERS REJ LOW	MASTERS ACC LOW	APPROVAL REQUIRED

4. EJECT – REJECTS

5. FEED BOWLS

6. SPECIAL REQUIREMENTS

COMMENTS

HS-406

Exhibit C

3.3.8 Facilities

FACILITY	FLOOR LOAD	CLEAR CEILING HT.	POWER	AIR	DRAIN	EXHAUST SYSTEM		FLOOR SPACE
Ultra Sonic Degreaser	400#	10 FT	460V AC	NO	YES	YES		8' x 8' SQ
Stress Relieve Oven	2000#	10 FT	440V AC	NO	NO	YES		10' x 12' SQ
Air Conditioner Equipment (Ceiling Mount)	N/A	20 FT	440V AC	NO	YES	NO		N/A
Humidity Chamber	100#	8 FT	110V AC	NO	NO	NO		8' x 8' SQ
Demagnetizer	500#	8 FT	460V AC	NO	NO	NO		5' x 5' SQ
Epoxy out-gassing Exhaust Equipment	N/A	8 FT	110V AC	YES	NO	YES		N/A

3.3.9

UTILITY CONSUMPTION

SAAF #	ELECT POWER	COMPRESSED AIR	FUEL OIL	GAS	WATER	STEAM
7	2.29	950	-	-	-	-
8	2.29	950	-	-	-	-
9	2.29	950	-	-	-	-
10	2.44	950	-	-	-	-
10A	2.44	950	-	-	-	-
11	2.51	950	-	-	-	-
12	2.67	950	-	-	-	-
12A	.42	950	-	-	-	-
12B	2.67	950	-	-	-	-
12C	.42	950	-	-	-	-
13	13.72	950	-	-	-	-
13A	2.44	950	-	-	-	-
TOTAL	36.60	11,400	-	-	-	-
UNIT	KWH/M	CFH/M				

The data listed above is from a 1977 Utility Useage Analysis, and comparable machines used on the ADAM Program at Honeywell, Twin City Arsenal, Building 103 New Brighton, Minnesota.

Exhibit C

3.3.9 UTILITY CONSUMPTION/OPERATIONAL RATE

	ELECTRICAL POWER KWH/HR					COMPRESSED AIR CF/HR			
SAAF #	KWH/HR	160 HR/MO	320 HR/MO	500 HR/MO	SAAF #	CF/HR	160 HR/MO	320 Hr/MO	500 HR/MO
7	2.29	366.4	732.8	1145.0	7	950	152,000	304,000	475,000
8	2.29	366.4	732.8	1145.0	8	950	152,000	304,000	475,000
9	2.29	366.4	732.8	1145.0	9	950	152,000	304,000	475,000
10	2.44	390.4	780.8	1220.0	10	950	152,000	304,000	475,000
10A	2.44	390.4	780.8	1220.0	10A	950	152,000	304,000	475,000
11	2.51	401.6	803.2	1255.0	11	950	152,000	304,000	475,000
12	2.67	427.2	854.4	1335.0	12	950	152,000	304,000	475.000
12A	.42	67.2	214.4	210.0	12A	950	152,000	304,000	475,000
12B	2.67	427.2	854.4	1335.0	12B	950	152,000	304,000	475,000
12C	.42	67.2	214.4	210.0	12C	950	152,000	304,000	475,000
13	13.72	2195.2	4390.4	6860.0	13	950	152,000	304,000	475,000
13A	2.44	390.4	780.8	1220.0	13A	950	152,000	304,000	475,000
TOTAL	36.60 -	5856.0 KWH/MO	11,712.0 KWH/MO	18,300.0 KWH/MO	TOTAL	11,400 -	1,824,000 CF/MO	3,848,000 CF/MO	5,700,000 CF/MO

4.2 Quality Conformance

a. Prior to the demonstration test, the following shall be verified:

- Identification area
- Proper function of feed, work and probe stations
- Control system must stop the SAAF and provide a numerical display to indicate the cause of the stoppage.
- Counters presence and function
- Safety
- Workmanship

This verification will be part of the physical and special criteria conformance.

b. During the conduct of the demonstration test, the following shall be recorded:

- Date of demonstration test
- Start time
- Stop time (Stops will be recorded by number displayed and/or reason for stop and duration of stop)
- Observed time
- Total run time
- Total down time
- Cycle rate (CPM)
- Total cycle count
- Total parts count
- Lot number of parts and material assembled

- Cause of failure
- Corrective action
- Time to determine corrective action
- Time to perform corrective action
- Total down time per failure

This data will be part of the performance and reliability analysis.

c. During and/or following the demonstration test, samples of SAAF-accepted assemblies shall be selected and inspected and/or tested for conformance to QAP-GEMSS-1. The inspection/test results will be part of the Quality evaluation.

5.0 PREPARATION FOR DELIVERY

Each assembly machine built is to be debugged before delivery and is to be considered a completed unit. Each machine is to be appropriately crated or packaged so that damage will not be incurred when moved from one facility to another.

APPENDIX C

INSPECTION PROCEDURES

FOR

THE EXTENDED TRIPLINE SENSOR ASSEMBLY

Specification: QAP-GEMSS-1 dtd 23 June 1977

APPENDIX C

INDEX - INSPECTION PROCEDURES
EXTENDED TRIPLINE SENSOR ASSEMBLY

DRAWING NO.	REVISION NO.	NOMENCLATURE	INSPECTION PROCEDURE ISSUE NO.
9292972	B	Tripline Sensor, Extended Range (2 Parts: Pre-seal and Post-Seal)	2
9292976	B	Sensor Case & Bobbin Assembly	2
9292980	B	Anchor	2
9292981	B	Eyelet, Interface	2
9292982	B	Bobbin Assembly	2
9292983	B	Weight, Bobbin	2
9292985	B	Bobbin	2
9292986	B	Release Mechanism & Case Assembly	2
9292987	B	Case, Sensor	2
9292988	B	Sleeve	2
9292989	B	Washer, Case	2
9292990	B	Spring, Booster	2
9292991	B	Release Mechanism Assembly	2
9292998	B	Diaphragm Assembly	2
9298575	Orig.	Cover, Post	2
9298576	Orig.	Wire, Magnet, Electrical	2
9298577	Orig.	Ring, Retaining, Breakwire	2
9298578	Orig.	Spring, Ejection	2
9298579	Orig.	Cap	2
9298581	Orig.	Ball, Locking	2
9298582	Orig.	Spring, Washer	2
9298586	Orig.	Ring, Ball Lock	2
9298587	Orig.	Housing Assembly	2
9298588	Orig.	Cup, Housing	2
9298589	Orig.	Tube, Housing	2

DRAWING NO.	REVISION NO.	NOMENCLATURE	INSPECTION PROCEDURE ISSUE NO.
9298591	Orig.	Tape	2
9298592	Orig.	Thread, Polyester	2
9298597	Orig.	Plate, Diaphragm	2
9298598	Orig.	Diaphragm	2
9298599	Orig.	Eyelet, Diaphragm	2
9298601	Orig.	Terminal, Breakwire	2
9298617	Orig.	Urethane Compound	2
9298618	Orig.	Gasket, Fibrous	2
9298619	Orig.	Paper, Gasket	2

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
SENSOR ASSY. (PRE SEAL)	EXT. TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9292972		0125	B	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	VISUAL - PRE SEAL	4.8.4	E-201									
1	PARTS MUST BE OF GOOD WORKMANSHIP AND MUST BE FREE OF DAMAGE	4.8.5	E-202				S		65			VISUAL
2	CHECK FOR PRESENCE OF STRAIGHT" BREAKWIRE", STAKED AND SOLDERED IN TWO PLACES. SOLDER JOINT MUST BE BRIGHT AND SMOOTH. BREAKWIRE MUST NOT EXTEND OUTSIDE THE O.D. OF THE ASSEMBLY.	4.8.4	E101				S		40			3 POWER MAGNIFIER
3	CHECK THAT THE BREAKWIRE RETAINING RING IS PROPERLY ENGAGED OVER THE BOBBIN POST	4.8.4	E102				S		40			3POWER MAGNIFIER

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(3)

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
SENSOR ASSY (POST SEAL)	EXT. TRIP UNIT	2		17 AUG 78
PART NUMBER	**PART FAMILY**	**OPERATION NUMBER**	**REV/MOD**	**TALLY NUMBER**
9292972		0295	B	
QEID	**INSPECTION DEPARTMENT**	**APPROVALS**		**SHEET**
M33				1 OF 3

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A.	VISUAL (POST SEAL).											
1	CHECK THAT SEAL ON BACK IS PRESENT COMPLETE AND NOT DAMAGED	4.2.5	E201				9		.65			3 POWER MAGNIFIER AND LIGHT
2	CHECK THAT SEAL MATERIAL DOES NOT EXTEND BEYOND LIP OF DIAPHRAGM.											
B.	PHYSICAL AND DIMENSIONAL											
1.	.536 MAX O.D.		A2				9		.40			GAGE
C.	FUNCTIONAL											
1.	CHECK THAT CONTINUITY FROM BREAKWIRE TERMINAL LEAD TO OTHER BREAKWIRE TERMINAL LEAD IS NOT GREATER THAN 10 OHMS		A1				SP			315	0	DIGITAL MULTIMETER

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
ELISOR ASSY (POST SEAL)	EXT. TRIP LINE	2		15 AUG 78
PART NUMBER	**PART FAMILY**	**OPERATION NUMBER**	**REV/MOD**	**TALLY NUMBER**
9258272		0295	B	
QEID	**INSPECTION DEPARTMENT**	**APPROVALS**		**SHEET**
M 33				2 OF 3

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
2	50 UNITS SHOULD BE SELECTED FROM THE PRECEEDING INSPECTION (C1), TESTED ACCORDING TO THE CONDITIONS LISTED IN NOTE 3; AND EVALUATED ACCORDING TO THE FOLLOWING.											H2B009656-E1 BARRIER UG-143L 1000 50' TAPE MEASURE
	.1 NON RELEASE (SPECIFIC PROCEDURE FOR PERFORMING THIS TEST IS PENDING AND CONFORMANCE IS WAIVED UNTIL A RESOLUTION IS REACHED)	4.2.6								50	1	1281122666E4
	.2 RELEASE	4.2.6								50	1	
	.3 TRIPLINE DEPLOYMENT	"								50	3	
	.4 BREAKWIRE FUNCTIONIN	"								50	3	
	.5 POST RETENTION AND THREAD BREAKING STRENGTH	"								A*		
	A* FOR INFORMATION ONLY - NO REJECTION											

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HI-20 REV 9/71

INSPECTION INSTRUCTION

REV. B

PART NO. 9292972

ITEM NO.	INSTRUCTIONS
C2	.1 MOUNT AN EXPENDED UNIT IN TEST FIXTURE (H28009656-E1) .2 PLACE A BARRIER AT A DISTANCE OF 32 FEET FROM THE FRONT OF THE SENSOR AND AT A HEIGHT OF SEVEN INCHES ABOVE THE TOP OF THE SENSOR .3 ADJUST THE AIR PRESSURE REGULATOR TO 300 ± 25 PSIG. .4 SET TIMER FOR 200 MILLISECONDS MAXIMUM .5 REMOVE EXPENDED UNIT FROM TEST FIXTURE
C2.2	.1 PLACE TEST UNIT IN H28009656-E1 TESTER AND CONNECT H2811226GE4 TESTER TO TEST UNIT LEADS (POLARITY IS INSIGNIFICANT) .2 READ CONTINUITY ON METER .3 PRESS BUTTON TO APPLY AIR PRESSURE TO RELEASE MECHANISM .4 RELEASE: THE EJECTION SPRING, SLEEVE, CAP, AND BOBBIN MUST BE RELEASED FROM THE CASE. IF ONE UNIT FAILS, REPLACE UNIT SO THAT 50 (FIFTY) UNITS REMAIN FOR NEXT ITEM OF TEST. IF TWO UNITS FAIL "RELEASE TEST", LOT IS REJECTED
.3	.1 TRIPLINE DEPLOYMENT: THE TRIPLINE MUST CLEAR THE BARRIER. IF 3 OR LESS UNITS FAIL, REPLACE UNITS IN SAMPLE SO THAT 50 (FIFTY) UNITS REMAIN FOR NEXT ITEM OF TEST. IF FOUR UNITS FAIL, REJECT LOT.
.4	.1 BREAKWIRE FUNCTION: ATTACH FORCE GAGE TO THE THREAD AT A DISTANCE OF APPROXIMATELY 32 FEET FROM CASE AND APPLY FORCE OF .3 TO .9 POUNDS TO BREAK "BREAK WIRE". BREAKING OF WIRE WILL BE INDICATED BY ILLUMINATION OF GREEN LIGHT ON TEST FIXTURE. THE FORCE APPLICATION SHOULD BE STEADY AND ALONG THE AXIS OF THE BOBBIN POST. THE BOBBIN POST SHOULD SHOULD REMAIN IN THE CASE. IF 3 OR LESS UNITS FAIL*, REPLACE UNITS IN SAMPLE SO THAT 50 UNITS REMAIN FOR NEXT ITEM OF TEST. IF 4 UNITS FAIL, REJECT LOT.
.5	.1 POST RETENTION AND THREAD BREAKING STRENGTH: AFTER B2.4.1 IS ACCOMPLISHED, CONTINUE THE PULL FORCE UNTIL THE THREAD BREAKS OR UNTIL A PULL FORCE OF 1.2 POUNDS IS REACHED. THE POST SHOULD REMAIN IN PLACE IN THE CASE. (INFORMATIONAL)

NOTE: *A NO MORE THAN ONE OF THE 2 ALLOWABLE DEFECTIVES SHALL EXCEED 1.2 POUNDS.

SOURCE

DIST.

INSP. OP.

REV. B

PART NO. 9292972

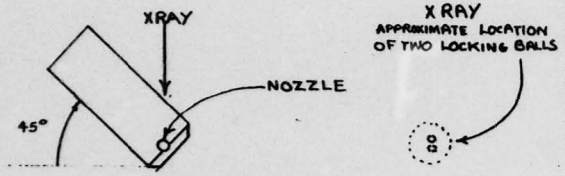
NAME	INSP. OP.	DEVICE NO.	INSPECTING DEPT.
SENSOR ASSEMBLY (POST SEAL)	0298	XM74	6021

ISSUE NO.	DATE	PAGE	OF	WRITER	APP.	APP.	APP.
2	16 AUG 78	3	3	Tamar	182		

INSPECTION PROCEDURE

SEN. CASE AND BOBBIN ASSY	PROGRAM: EXT. TRIP LINE	IP ISSUE: 2	SAMPLING PLAN REVISION:	DATE: 7 AUG 78	
9929976	PART FAMILY:	OPERATION NUMBER: 0395	REV/MOD: B	TALLY NUMBER:	
	INSPECTION DEPARTMENT:	APPROVALS:		SHEET: 1 OF 2	

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	XRAY											
1	XRAY TO BE TAKEN WITH ASSEMBLY POSITIONED AS SHOWN IN SKETCH "A". XRAY TECHNICIAN WILL INTERPRET PRINTS FOR IDENTIFICATION OF LOCKING BALLS AND NOTIFY INSPECTION FOR VERIFICATION									50	1	XRAY
B	VISUAL AND DIMENSIONAL											
1	CHECK THAT THE FOUR CAP TABS OVERLAY THE FOUR CRIMPED SLEEVE TABS (SMALL GAP UNDER CRIMPS IS PERMISSIBLE.)	4.2.5	E101				9		40			VISUAL
2	CHECK FOR PRESENCE OF ANCHOR - VISIBLE THROUGH HOLE IN CAP END OF THE ASSEMBLY.											



SKETCH "A" SENSOR CASE AND BOBBIN ASSEMBLY

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
SENSOR CASE AND BOBBIN ASS'Y	EXT. TRIP UNIT	2		15 AUG 78
PART NUMBER	**PART FAMILY**	**OPERATION NUMBER**	**REV/MOD**	**TALLY NUMBER**
9292976			B	
QEID	**INSPECTION DEPARTMENT**	**APPROVALS**		**SHEET**
M 93				2 OF 2

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
3	ORIENTATION OF BOBBIN ASSEMBLY SUCH THAT POST SLOT IS ROTATED APPROXIMATELY 90° WITH RESPECT TO NOZZLE ON DIAPHRAGM ASSEMBLY.		A2				9		1			VISUAL

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
ANCHOR	EXT. TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9292980			B	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	**DIE/MOLD CHECK** AN ACCEPTABLE DIE/MOLD CHECK FOR EACH DIE OR MOLD CAVITY TO THE LATEST PRINT REVISION FOR EACH VENDOR MUST BE IN THE INSPECTION FOLDER. IF NOT, CALL QE									2	0	MSI
B	VISUAL											
1	CHECK HARDNESS AND TEMPER TO RISN 80 TO 83 (MIL-S-46049)		A2							5	0	ROCKWELL TESTER
2	PARTS TO BE FREE OF DAMAGE AND MUST BE OF GOOD WORKMANSHIP		C				9		1.0			VISUAL
3	PROPER DIE RADIUS, BURRS PERMITTED PER NOTE 5		B2				9		1.0			VISUAL
4	PROTECTIVE FINISH, LUSTERLESS GREEN		C				9		1.0			VISUAL
C	DIMENSIONAL											
1	.0050 ± .0005		B2				9		1.0			UGTG H28112274-GC1
2	CHECK PART PROFILE (2 POSITIONS EA.)		B2				9		1.0			COMPARATOR

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
EYELET, INTERFACE	EXT TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9292981			B	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	VISUAL											
1	PARTS TO HAVE BLACK OXIDE FINISH		C				9		1.0			VISUAL
2	PARTS TO BE FREE OF DAMAGE AND MUST BE OF GOOD WORKMANSHIP		D				9		4.0			VISUAL
3	NO BURRS PERMITTED AS NOTED		B2				9		1.0			VISUAL
D	DIMENSIONAL											
1	.390 +.005 DIA		B2				9		1.0			STD. PIN GAGE
2	.475 -.005		D				9		4.0			1" MICR.
3	.065 -.010		B2				9		1.0			DEPTH MICR.

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
BOBBIN ASS'Y	EXT. TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9292082		0195	B	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M-33			1 OF 3

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	VISUAL											
1	CHECK FOR PROPER SECURING OF BOTH ENDS OF THE THREAD TO THE BOBBIN											VISUAL
	.1) LARGE END BOBBIN: THREAD SHOULD BE IN SLOT AND NOT VISIBLE THROUGH HOLE IN BOBBIN WEIGHT	7C	B1				9		1.0			VISUAL
	.2) SMALL FLANGE END BOBBIN: THREAD SHOULD BE AS SHOWN IN PRINT AND SECURED WITH TAPE. (NOTES	3C	B1				9		1.0			VISUAL
2	THE THREAD SHOULD NOT TOUCH THE SMALL SHAFT DEPARTING THE TWO FLANGES		A1				9		1.0			VISUAL
3	DIRECTION OF WIND SHALL BE CLOCKWISE WHEN VIEWED FROM FLANGE END.		A1				9		1.0			VISUAL
4	WORKMANSHIP: NO LOOSE THREADS SHALL EXTEND OVER BODY OF BOBBIN OTHER THAN AS SHOWN ON PRINT AND NO CRACKS SHALL BE VISIBLE AT MOLD PARTING LINE		A1				9		1.0			VISUAL

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
BOBBIN ASSEMBLY	EXT. TRIC LINE	2		14 AUG 78
PART NUMBER	**PART FAMILY**	**OPERATION NUMBER**	**REV/MOD**	**TALLY NUMBER**
9E329A2			B	
QEID	**INSPECTION DEPARTMENT**	**APPROVALS**		**SHEET**
M-33				2 OF 3

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
B	DIMENSIONAL AND THREAD STRENGTH											
1	CUT OFF POST WITH AN "EXACTO KNIFE" BEING CAREFUL NOT TO CUT THREAD OR UNWIND FROM THE POST. (INSERT A #2-56 X 3/8" S.T. SCREW TO SECURE WEIGHT WHILE MEASURING THE THREAD LENGTH) PLACE POST IN VICE. UNWIND THREAD HOLDING WEIGHT END OF BOBBIN.*A MEASURE THREAD LENGTH PER NOTE 2 (46 ± 3 FEET)									38	1	BENCH VICE, C CLAMP, TAPE MEASURE.
2	REPEAT UNWINDING PROCEDURE DESCRIBED IN 1 ABOVE FOR REMAINDER OF SAMPLES TO BE TESTED.*B WITH POST SECURED IN VICE, ATTACH A FORCE GAGE TO THE THREAD AT A DISTANCE OF 2.0 FT FROM VICE. ASSURE THREAD IS STILL WOUND ON POST AND OVER FLANGE. PULL THREAD EVENLY IN A DIRECTION OPPOSITE TO THE POST. THE THREAD AND TAPED END MUST WITHSTAND AN AXIAL FORCE PER NOTE 3. (1.2 LBS)									38	1	BENCH VICE C CLAMP UG-143 L1000

*A IF THREAD TANGLES, REPLACE UNIT.

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
COIL-IN ASSEMBLY	EXT. TRIP LINE	2		14 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
3P9B9A2			B	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M-33			3 OF 3

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
3	CONTINUE WITH SAMPLE FROM 2. LEAVE SEVERAL WRAPS OF THREAD ON BOBBIN AND SECURE WEIGHT END OF BOBBIN IN VICE SUCH THAT AN AXIAL LOAD MAY BE APPLIED. APPLY AXIAL LOAD PER NOTE 3 (1.2 POUNDS)									38	1	BENCH VICE C LAMP UG 143 L1000

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
WEIGHT, BOBBIN	EXT. TRIPLINE	2		7 AUG 78
PART NUMBER	**PART FAMILY**	**OPERATION NUMBER**	**REV/MOD**	**TALLY NUMBER**
9292983			B	
QEID	**INSPECTION DEPARTMENT**	**APPROVALS**		**SHEET**
M33				1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	VISUAL											
1	PARTS TO BE FREE OF DAMAGE AND MUST BE OF GOOD WORKMANSHIP		C				9		1.0			VISUAL
B	DIMENSIONAL											
1	.280-.005 DIA.		B2				9		1.0			1" MICR.
2	.180-.010		B2				9		1.0			1" MICR.
3	.100 +.005 DIA.		B2				9		1.0			GH488

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
BOBBIN	EXT. TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9292985			B	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 2

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	**DIE/MOLD CHECK** AN ACCEPTABLE DIE/MOLD CHECK FOR EACH DIE OR MOLD CAVITY TO THE LATEST PRINT REVISION FOR EACH VENDOR MUST BE IN THE INSPECTION FOLDER. IF NOT, CALL QE		A2							1	0	MS1
B	BC CERTIFICATION PER NOTE 2 ON PILOT LOT		A2									VISUAL
C	VISUAL PARTS MUST BE FREE OF DAMAGE, EXCESSIVE FLASH (NOTE 5)											
1	AND MUST BE OF GOOD WORKMANSHIP.		A2									VISUAL
2	.34 DIA X ≈ 135° FLANGE PRESENT	D7	B2				9		1.0			VISUAL
3	PRESENCE OF .070 +.002 "D" (NOTE 4)	H7	B2				9		1.0			VISUAL .069 DIA. PIN MUST ENTER FOR INFO. ONLY
D	DIMENSIONAL											
1	.032 −.005		B2				9		1.0			1" MICR.
2	.175 − .005		B2						1.0			DEPTH MICR.
3	.685 -.010 (2PLACES)		B2						1.0			1" MICR. (6X8142-C2
4	.218 −.005		B2						1.5			KODAK CHART
5	.255 -.005		B2						1.0			"
6	.015 ±.005 (2 PLACES)		B2						1.0			"
7	.050 ±.008		B2						1.0			"

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
BOBBIN	EXT. TRIP LINE	2		8 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9292985			B	

NEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
			2 OF 2

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
8	.020 +.005		B2				9		1.0			KODAK CHART
9	.005 MAXR		B2						1.5			" "
10	.056 -.005 DIA		B2						1.0			" "
11	.058 -.003 DIA		B2						1.0			" "
12	.077 -.004 DIA		B2						1.0			" "
13	.098 -.004 DIA		B2						1.5			" "
14	.005 ±.005		B2						1.5			" "

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
RELE. SE MECHANISM AND CASE ASSEMBLY	EXT. TRIP LINE	2		7 AUG 78
PART NUMBER	**PART FAMILY**	**OPERATION NUMBER**	**REV/MOD**	**TALLY NUMBER**
9292986		0295	B	
QEID	**INSPECTION DEPARTMENT**	**APPROVALS**		**SHEET**
				1 OF 2

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	VISUAL											
1	CHECK FOR PRESENCE OF PARTS:											
	.1 "SLEEVE" (9292988)		A2				9		.65			VISUAL
	.2 "RELEASE MECHANISM ASSEMBLY" (9292991)		A2				9		.65			"
	.3 "CASE, SENSOR" (9292987)		A2				9		.65			"
2	PARTS MUST BE FREE OF DAMAGE AND MUST BE OF GOOD WORKMANSHIP											
	.1 CHECK FOR DAMAGED "DIAPHRAGM ASSEMBLY"						9		1.0			VISUAL
	.2 CHECK "SLEEVE" FOR DENTS AND STRAIGHT TABS						9		1.0			"
	.3 CHECK "CASE, SENSOR" FOR DENTS.						9		1.0			"
3	CHECK "RELEASE MECHANISM ASSEMBLY" FOR PROPER SEATING IN "CASE, SENSOR". THE METAL CASE OF THE "HOUSING ASSEMBLY" MUST NOT BE VISIBLE IN OPEN PORTS BETWEEN THE CRIMPED AREAS, AND THE NOZZLE OF THE RELEASE MECHANISM MUST BE LOCATED WITHIN AN OPEN PORT						9		1.0			VISUAL
4	CHECK FOR "CRIMP ALL AROUND"											VISUAL

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
RELEASE MECHANISM AND CASE ASSEMBLY	EXT. TRIP LINE	2		15 AUG 1978

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9296086			B	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M-33			2 OF 2

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
5	CHECK THAT SLEEVE IS LOOSE AND IS NOT BINDING WITHIN THE "CASE, SENSOR".						9		1.0			VISUAL
B	XRAY											
1	XRAY SAMPLE FOR FOUR LOCKING BALLS									50	1	XRAY

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
CASE, SENSOR	EXT. TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9292987			B	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	**DIE/MOLD CHECK** AN ACCEPTABLE DIE/MOLD CHECK FOR EACH DIE OR MOLD CAVITY TO THE LATEST PRINT REVISION FOR EACH VENDOR MUST BE IN THE INSPECTION FOLDER. IF NOT, CALL QE		A2							2	0	MSI
B	BQ CERTIFICATION REQUIRED PER NOTE 3		A2							PILOT LOT		VISUAL
C	VISUAL											
1	PARTS TO BE FREE OF DAMAGE AND MUST BE OF GOOD WORKMANSHIP		C				9		1.0			VISUAL
D	DIMENSIONAL											
1	.930 -.010		B2				9		1.0			MICR.
2	.865 -.010 4 PLACES		B2									UG312
3	.495 ±.005 DIA.		B2									STD. PIN GAGE
4	.785 -.008 PER NOTE 5		B2									MSI
5	.025 MAX PER NOTE 6.		B2									MSI
6	.475 ±.005 DIA. PER NOTE 8		B2									H28109188-G1
7	.446 ±.010 DIA.		B2						.5			STD. PIN GAGE

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
SLEEVE	EXT TRIP LINE	2		7 AUG 78

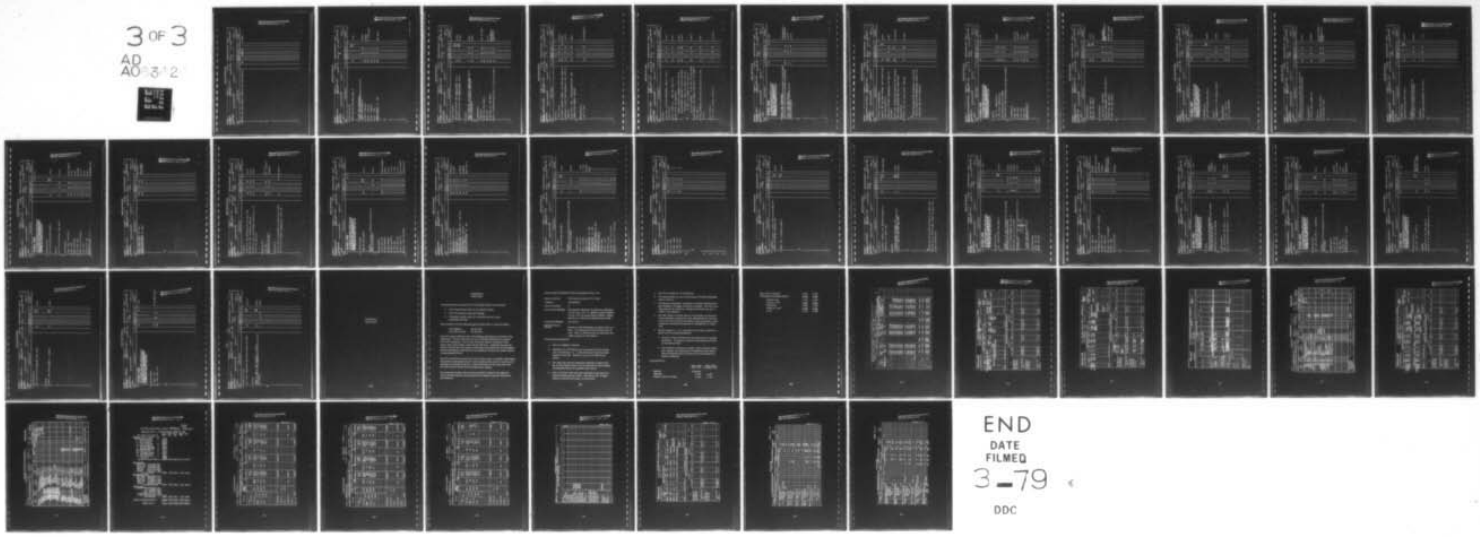
PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9292988			B	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 2

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	**DIE/MOLD CHECK** AN ACCEPTABLE DIE/MOLD CHECK FOR EACH DIE OR MOLD CAVITY TO THE LATEST PRINT REVISION FOR EACH VENDOR MUST BE IN THE INSPECTION FOLDER. IF NOT, CALL		A2							2	O	MS1
B	CERTIFICATION											
1	BQ CERTIFICATION PER NOTE 3		A2							PILOT LOT		VISUAL
C	VISUAL PARTS MUST BE FREE OF DAMAGE AND MUST BE OF											
1	GOOD WORKMANSHIP		C				9		1.0			VISUAL
2	"DIE RADIUS SIDE" AS SHOWN		A2				9		1.0			VISUAL
D	DIMENSIONAL											
1	.0125 ± .0015		B2				9		1.0			MICR. UG156
2	.061 + .004 DIA (4 PLACES)											GH 854
3	⌖ | A | .010 DIA | ON .061 DIA											H28112281G1
4	.11 - .01 (4 PLACES)											VERNIER CALIPER
5	.75 - .01											" "
6	.18 - .01											DEPTH MICR.
7	.355 ± .005											STD. PIN GAGE

AD-A063 424 HONEYWELL INC HOPKINS MN DEFENSE SYSTEMS DIV F/G 19/1
PRODUCIBILITY ENGINEERING AND PLANNING (PEP) OF THE XM74 GEMSS --ETC(U)
AUG 78 R FAIRCHILD DAAK10-77-C-0047
UNCLASSIFIED 47419 NL

3 OF 3
AD
AD A063 424



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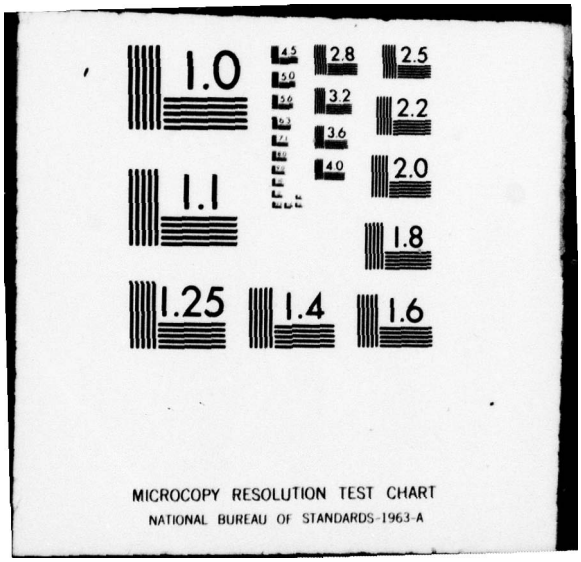
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

INSPECTION PROCEDURE

PART NAME	PROGRAM	ISSUE	SAMPLING PLAN REVISION	DATE
SLEEVE	EXT. TRIP LINE	2		8 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9292988			B	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
			2 OF 2

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
8	PARTS MUST DROP THROUGH A .389 DIA. RING GAGE (NOTE 5)		B2				18	S3	.65			GH 3340

197

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
WASHER, CASE	EXT. TRIP LINE	2		7 AUG 78
PART NUMBER	**PART FAMILY**	**OPERATION NUMBER**	**REV/MOD**	**TALLY NUMBER**
9298985			B	
QEID	**INSPECTION DEPARTMENT**	**APPROVALS**		**SHEET**
M33				1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	CERTIFICATION											
1	BQ CERTIFICATION PER NOTE 3		A2							PILOT LOT		VISUAL
B	VISUAL AND DIMENSIONAL PARTS TO BE FREE OF DAMAGE AND MUST BE OF											
1	GOOD WORKMANSHIP		C				9		1.0			VISUAL
2	.392 +.002 DIA.		B2									GH3301
3	.474 -.003 DIA.		B2									1" MICR., UG-111
4	.415 -.005 DIA.		B2									" " "
5	.150 -.005		B2									" " "
6	⌖ A .002 OF .392		B2									OPEN SET-UP

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
SPRING, BOOSTER	EXT. TRIP LINE	2		7 AUG 79

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9292990			B	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	CERTIFICATION											
1	BQ CERTIFICATION PER SPECIAL DATA ITEM A		A2							PILOT LOT		VISUAL
2	BQ CERTIFICATION PER SPECIAL DATA ITEM C		A2							PILOT LOT		VISUAL
B	VISUAL											
1	ENDS CLOSED BUT NOT GROUND SPECIAL DATA ITEM B		C				9		1.0			VISUAL
2	PARTS TO BE FREE OF DAMAGE AND MUST BE OF GOOD WORKMANSHIP		B2				9		1.0			VISUAL
C	DIMENSIONAL											
1	.385 ±.010		B2				9		1.0			STD. PIN GAGE
2	.395±.010 PER NOTE 8		B2									" " "
3	3.00 ± .20		B2									SCALE
4	.455 MAX DIA. PER NOTE 9		B2									M28112284-G1 SPRING TESTER + M28112271-G2
5	LOAD AT COMPRESSED LENGTH OF .40 IN = 5± 0.5 LB. PER NOTE 7		B2									

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
RELEASE MECHANISM ASS'Y	EXT. TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9292991		0295	B	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M-33			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	VISUAL											
1	360° CRIMP		B2				9		1.0			VISUAL
2	2 SPRING WASHERS PRESENT AND POSITIONED PROPERLY		A2							55	1	XRAY
3	ASSEMBLY TO BE OF GOOD WORKMANSHIP AND FREE OF DEFECTS		A2				9		1.0			VISUAL
4	CHECK THAT TWO "TERMINALS, BREAKWIRE" ARE PRESENT AND PROPERLY STACKED		A2				S		1.0			VISUAL
B	DIMENSIONAL											
1	.157 ± .002		A2				9		1.0			H28009650-G1

200

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
DIAPHRAGM ASS'Y	EXT. TRIP LINE	2		7 AUG 78
PART NUMBER	**PART FAMILY**	**OPERATION NUMBER**	**REV/MOD**	**TALLY NUMBER**
9202998		0395	D	
QEID	**INSPECTION DEPARTMENT**	**APPROVALS**		**SHEET**
M-33				1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	VISUAL											
1	PRESENCE OF PARTS: DIAPHRAGM, EYELET, PLATE, AND GASKET		A2				9		1.0			VISUAL
2	CHECK "FLARE ALL AROUND" PER NOTES 2 & 3		B2				9		1.5			VISUAL
3	CHECK PARTS FOR FOLLOWING:											
	.1) BROKEN OR SPLIT DIAPHRAGM PLATE NOZZLE		B2				9		1.0			VISUAL
	.2) DIAPHRAGM DAMAGED IN FUNCTIONAL AREA (FUNCTIONAL AREA: THAT PORTION HALF WAY UP THE O D FLANGE TO THE EYELET)		B2				9		1.0			VISUAL
	.3) EYLET FLANGE TO BE FLAT AND UNDAMAGED		B2				9		1.0			VISUAL
4	CHECK GASKET FOR PROPER ORIENTATION OF TONGUE PER NOTE 4		B2				9		1.0			VISUAL
5	CHECK DIAPHRAGM FOR NOTCH AND ORIENTATION PER NOTE 5		B2				9		1.0			VISUAL
B	DIMENSIONAL											
1	.016 ± .003 (METAL TO METAL)		A1				9		1.0			GAGE BL46

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
COVER, POST	EXT. TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9298575			ORIG	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	**DIE/MOLD CHECK** AN ACCEPTABLE DIE/MOLD CHECK FOR EACH DIE OR MOLD CAVITY TO THE LATEST PRINT REVISION FOR EACH VENDOR MUST BE IN THE INSPECTION FOLDER. IF NOT, CALL QE	A2								2	0	MSI
B	VISUAL AND DIMENSIONAL CHECK THE PART PROFILE USING CHART (ATTEMPT TO SELECT SAMPLE											H28112269 G1 +
1	SUCH THAT EACH CAVITY OF MOLD IS EQUALLY REPRESENTED)	B2					9		1.0			COMPARATOR
2	CAVITY IDENT PER NOTE 3	D					9		1.0			VISUAL
3	PARTS TO BE FREE OF DAMAGE AND OF GOOD WORKMANSHIP	C					9		1.0			VISUAL

202

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
WIRE, MAGNETIC, ELECTRICAL	EXT. TRIP LINE	2		7 AUG 78
PART NUMBER	**PART FAMILY**	**OPERATION NUMBER**	**REV/MOD**	**TALLY NUMBER**
9298576			ORIG	
QEID	**INSPECTION DEPARTMENT**	**APPROVALS**		**SHEET**
M33				1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	VISUAL AND DIMENSIONAL											
1	IDENTIFY PART AND DASH NUMBER- PART IDENTIFICATION AND CONFIGURATION		B1							EA LOT		VISUAL
2	PARTS TO BE OF GOOD WORKMANSHIP AND FREE OF DAMAGE.		E 202				9		.65			VISUAL
3	CHECK WIRE APPROXIMATELY ONE FOOT FROM ONE END, THE OUTSIDE DIAMETER MUST FALL WITHIN PRINT SPECIFICATION		E 201						*A			MICROMETER
4.	CHECK FOR POLYURETHANE COATING		C						*A			VISUAL

203

*A
SELECT ONE SAMPLE FROM THE BEGINING OF EACH SPOOL OR COIL. FAILURE OF THE SAMPLE SHALL REJECT THE SPOOL/COIL FOR USE IN PRODUCTION

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
RING, RETAINING, BREAKWIRE	EXT. TRIP LINE	2		7 AUG 78
PART NUMBER	**PART FAMILY**	**OPERATION NUMBER**	**REV/MOD**	**TALLY NUMBER**
9298577			ORIG	
QEID	**INSPECTION DEPARTMENT**	**APPROVALS**		**SHEET**
M33				1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	**DIE/MOLD CHECK** AN ACCEPTABLE DIE/MOLD CHECK FOR EACH DIE OR MOLD CAVITY TO THE LATEST PRINT REVISION FOR EACH VENDOR MUST BE IN THE INSPECTION FOLDER. IF NOT, CALL		A2							3	0	MSI
B	VISUAL											
1	45° - 5° PRESENCE OF		B2				9		1.0			VISUAL
2	.005 ±.003 PRESENCE OF		B2				"		1.0			"
3	DIE RADIUS SIDE (AS NOTED)		B2				9		1.0			"
4	PARTS TO BE OF GOOD WORKMANSHIP AND FREE OF DAMAGE		C				"		1.0			"
C	DIMENSIONAL											
1	.095 -.005		B2				9		1.0			STD MICR.
2	.058 +.002		B2									GH 2000
3	.010 ±.001		B2									MICR
4	.013 ±.003		B2									MICR
5	◈ A .002 DIA		B2									OG 8070

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
SPRING, EJECTION	EXT. TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9298578			ORIG	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	CERTIFICATION											
1	BQ CERT PER NOTE 2		A2							PILOT LOT		VISUAL
2	BQ CERT PER NOTE 3		A2							PILOT LOT		VISUAL
B	DIMENSIONAL											
1	.455 MAX DIA. PER NOTE 11		B2				9		1.0			RING GAGE
2	LOAD AT COMPRESSED LENGTH PER NOTE 10		A2									SPRING TESTER AND HARRINGTON-GE SPRING TEST NEST
3	2.00 ±.20 FREE LENGTH		B2									VERNIER CALIPER
4	.365 +.010 PER NOTE 6		B2									STD. PIN GAGE

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
CAP	EXT. TRIP LINE	2		7 AUG 78
PART NUMBER	**PART FAMILY**	**OPERATION NUMBER**	**REV/MOD**	**TALLY NUMBER**
9298579			ORIG	
QEID	**INSPECTION DEPARTMENT**	**APPROVALS**		**SHEET**
M33				1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	**DIE/MOLD CHECK** AN ACCEPTABLE DIE/MOLD CHECK FOR EACH DIE OR MOLD CAVITY TO THE LATEST PRINT REVISION FOR EACH VENDOR MUST BE IN THE INSPECTION FOLDER. IF NOT, CALL		A2							3	0	MS1
B	CERTIFICATION											
1	BC CERTIFICATION PER NOTE 2		A2							PILOT LOT		VISUAL
C	VISUAL											
1	PRESENCE OF ZINC COATING (NOTE 3)		C				9		1.0			VISUAL
D	DIMENSIONAL											
1	.474 - .010 DIA		B2				9		1.0			1" MIC
2	.12 +.01 (4PLACES)		B2				9		1.0			1" MIC

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
BALL, LOCKING	EXT. TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9298581			OR16	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	VISUAL PARTS MUST BE OF GOOD WORKMANSHIP AND FREE OF											
1	NICKS, DENTS, SCRATCHES OR OTHER DAMAGE		A2				9		1.0			VISUAL
B	DIMENSIONAL											
1	.0469 ± .0002 SPHER. DIA.		B2				9		1.0			UG 389 A
C	SPECIAL											
1	HARDNESS PER NOTE 2		A2				9		1.0			ROCKWELL HARDNESS TESTER
2	FINISH PER NOTE 1		A2				9		1.0			MICROSCOPE AND UG 15B

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
SPRING, WASHER	EXT. TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9298582			ORIG	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	CERTIFICATION											
1	BQ CERTIFICATION PER NOTE 2.		A2							PILOT LOT		VISUAL
B	VISUAL											
	PARTS MUST BE OF GOOD WORKMANSHIP AND											
1	TO BE FREE OF DAMAGE AND BURRS.		C				9		1.0			VISUAL
C	SPECIAL											
	SPRING LOAD REQUIREMENTS PER NOTE 3.		A2				9		1.0			MSI

208

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
RING, BALL LOCK	EXT. TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9298586			ORIG	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 2

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	**DIE/MOLD CHECK** AN ACCEPTABLE DIE/MOLD CHECK FOR EACH DIE OR MOLD CAVITY TO THE LATEST PRINT REVISION FOR EACH VENDOR MUST BE IN THE INSPECTION FOLDER. IF NOT, CALL									2	O	MS1
B	CERTIFICATION											
1	BC CERTIFICATION FOR NOTE 2		A2							PILOT LOT		VISUAL
C	VISUAL											
1	CAVITY IDENTIFICATION PER NOTE 3		D				9		1.0			VISUAL
D	DIMENSIONAL											
1	.261 -.005 (2 PLACES)		B2				9		1.0			GAGE (GX8017)
2	.092 -.004		B2									MICR.
3	.307 -.004 DIA.		B2									MICR.
4	.171 +.004 DIA.		B2									GH3369
5	.294 -.003 (2 PLACES)		B2									UG-111R
6	.075 -.004		B2									UG1841
7	.146 +.002 DIA		B2									GH921
8	Ⓢ B .004 DIA OF .171		B2				↓		↓			H28009940-G1+G2

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
RING, BALL LOCK	EXT. TRIP LINE	2		9 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9298586			ORIG	

DEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
			2 OF 2

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
9	◆ A .002 TOTAL OF .261		B2				9		1.0			TOOL MIC.
10	◆ A B .005 TOTAL OF .005		B2				9		1.0			TOOL MAKERS MICROSCOPE

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
HOUSING ASS'Y	EXT. TRIP LINE	2		7 AUG 78
PART NUMBER	**PART FAMILY**	**OPERATION NUMBER**	**REV/MOD**	**TALLY NUMBER**
9298587		0195	ORIG	
QEID	**INSPECTION DEPARTMENT**	**APPROVALS**		**SHEET**
M-33				1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	VISUAL											
1	PRESENCE AND POSITIOING OF CUP AND TUBE		B2				9		1.0			VISUAL
2	PRESENCE OF "CRIMP ALL AROUND"		B2				9		1.0			VISUAL
3	ASSEMBLY SHALL BE OF GOOD WORKMANSHIP AND FREE OF DEFECTS		B2				9		1.0			VISUAL
B	DIMENSIONAL											
1	.005 MAX		B2				9		1.0			VISUAL OR DIAL INDICATOR
2	⌖ A B .004 DIA		B1				9		1.0			OG8026
C	FUNCTIONAL											
1	CRIMP SHALL WITHSTAND A SEPARATION FORCE OF 10.0 LBS WITHOUT LOOSENING. (NOTE 2)		A1							35	0	OG8036

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
CUP, HOUSING	EXT. TRIP LINE	2		7 AUG 78
PART NUMBER	**PART FAMILY**	**OPERATION NUMBER**	**REV/MOD**	**TALLY NUMBER**
9298588			ORIG	
QE ID	**INSPECTION DEPARTMENT**	**APPROVALS**		**SHEET**
M33				1 OF 2

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	**DIE/MOLD CHECK** AN ACCEPTABLE DIE/MOLD CHECK FOR EACH DIE OR MOLD CAVITY TO THE LATEST PRINT REVISION FOR EACH VENDOR MUST BE IN THE INSPECTION FOLDER. IF NOT, CALL QE.									2	0	
B	CERTIFICATION											
1	BQ CERT PER NOTE 2		A2						PILOT LOT			VISUAL
C	VISUAL PARTS TO BE FREE OF DAMAGE AND MUST BE OF											
1	GOOD WORKMANSHIP		C				9		1.0			VISUAL
D	DIMENSIONAL											
1	.181 +.002 DIA.		B2				9		1.0			GAGE (EX8134)
2	.045 +.005 DIA											GH510
3	.050 +.003 DIA											GH016
4	.352 -.004 DIA											1" MICR
5	.132 +.003											1" MICR
6	.474 -.003 DIA.											1" MICR
7	.311 +.004 DIA.											STD. PIN GAGE
8	.036 -.004 (2 PLACES)											H2811103-61

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
CUP, HOUSING	EXT. TRIP LINE	2		9 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9298588			ORIG	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
			2 OF 2

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
9	.010 - .003 (2 PLACES)		B2				9		1.5			H28111103-G1
10	⌖ A .004 OF .474 DIA.		B2						1.0			OG 8067
11	⌖ A .004 OF .311 DIA.		B2									"
12	⌖ A B C .004 OF .050 DIA. & .045 DIA.		B2									OG 8069
13	⌖ D A .004 OF .352 DIA.		B2									OG 8068
14	⌖ A B .004 TOTAL OF .036		B2									H28111103-G1

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
TUBE, HOUSING	EXT. TRIP LINE	2		7 AUG 78
PART NUMBER	**PART FAMILY**	**OPERATION NUMBER**	**REV/MOD**	**TALLY NUMBER**
9298589			ORIG	
QEID	**INSPECTION DEPARTMENT**	**APPROVALS**		**SHEET**
M33				1 OF 2

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	CERTIFICATION											
1	BC CERTIFICATION PER NOTE 2		A2							PILOT LOT		VISUAL
B	VISUAL											
1	PARTS MUST BE OF GOOD WORKMANSHIP AND MUST BE FREE OF DAMAGE AND BURRS		C				9		1.0			VISUAL
C	DIMENSIONAL											
1	.144 -.003 DIA.		B2				9		1.0			1" MICR
2	.120 -.002 DIA.						9		1.0			1" MICR
3	.085 ±.004						9		1.0			GH 2087
4	⌖ A .002 DIA ON .085											GAGE
5	⌖ A .002 DIA ON .120											
6	⌖ A D .004 TOTAL ON .040											
7	⌖ A .004 TOTAL											
8	.045 ±.005											
9	.032 -.010											
10	.049 ± .002											
11	.040 ±.003 (2 PLACES)						9		1.0			
12	.050 ±.003 DIA (2 PLACES						9		1.0			

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
TUBE HOUSING	EXT. TRIP LINE	2	1	9 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9298589			ORIG	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
			2 OF 2

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
13	.017 MIN		B2				9		1.0			GAGE
14	.010-.002											
15	.030-.005											
16	.060-.004											
17	.126-.003											

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
TAPE	EXT TRIP LINE	2		7AUG78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9298591			ORIG	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	VISUAL											
	VERIFY THAT TAPE IS PROPER PART NUMBER (853) AND											
1	FROM AN APPROVED SOURCE (3M)									EA LOT		VISUAL
2	SHELF LIFE - 9 MONTHS, CODE B									EA LOT		MANUAL

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
THREAD, POLYESTER	EXT. TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9298592			ORIG	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	SPECIAL											
1	INSPECT THREAD FOR BREAKING STRENGTH AS SPECIFIED IN NOTE 1-B.		E 101						#A	EA SPOOL	0	PULL FORCE GAGE
B	VISUAL											
1	THREAD COLOR PER NOTE 1-C. NO VISIBLE DAMAGE, CUTSTRANDS, OR SHARP KINKS -		C							EA SPOOL	0	VISUAL
2	CHECK 1 PIECE 5' LONG FROM EACH SPOOL		C							EA SPOOL	0	VISUAL

#A
SELECT ONE SAMPLE FROM THE BEGINING OF EACH SPOOL. FAILURE OF THE SAMPLE SHALL REJECT THE SPOOL FOR USE IN PRODUCTION.

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
PLATE, DIAPHRAGM	EXT. TRIP LINE	2		7 AUG 78
PART NUMBER	**PART FAMILY**	**OPERATION NUMBER**	**REV/MOD**	**TALLY NUMBER**
9298597			ORIG	
QEID	**INSPECTION DEPARTMENT**	**APPROVALS**		**SHEET**
M33				1 OF 2

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	**DIE/MOLD CHECK** AN ACCEPTABLE DIE/MOLD CHECK FOR EACH DIE OR MOLD CAVITY TO THE LATEST PRINT REVISION FOR EACH VENDOR MUST BE IN THE INSPECTION FOLDER. IF NOT, CALL QE		A2							2	0	MSI
B	CERTIFICATION											
1	BC CERTIFICATION PER NOTE 2		A2							PILOT LOT		VISUAL
C	VISUAL											
1	PARTS TO BE OF GOOD WORKMANSHIP AND MUST BE FREE OF DAMAGE AND EXCESSIVE FLASH.		C				9		1.0			VISUAL
2	CAVITY IDENTIFICATION PER NOTE 4		D				9		1.0			VISUAL
3	INLET PORT MUST NOT BE BLOCKED		M 101				9		.40			VISUAL
4	NO CRACKS PRESENT WHEN SLIGHT FINGER PRESSURE APPLIED AS INDICATED  ① APPLY FINGER PRESSURE (SLIGHT) ② INSPECT FOR CRACKS		A2				9		1.0			VISUAL
C	DIMENSIONAL											
1	.102 -.005 DIA.		B2				18	SS	1.0			MICR.
2	.450 -.005 DIA		B2				18	SS	1.0			MICR.

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
PLATE, DIAPHRAGM	EXT. TRIP LINE	2		9 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9298597			ORIG	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
			2 OF 2

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
3	.162 +.004 DIA.		B2				9		1.0			GH1485
4	.052 -.004											GH158 +.001 INDICATOR
5	PRESENCE OF .006 +.004 (4PLACES)											MICROSCOPE
6	.028 +.004 DIA											GH2046
7	.070 -.003 DIA											UG111 M28192B6-G1, G158, 16158A OR EQUIVALENT
8	.070 -.010 (2 PLACES)											" " " " "
9	.026 +.004											
10	.230 +.004 DIA.											GH2606

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
DIAPHRAGM	EXT. TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9298598			ORIG	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	**DIE/MOLD CHECK** AN ACCEPTABLE DIE/MOLD CHECK FOR EACH DIE OR MOLD CAVITY TO THE LATEST PRINT REVISION FOR EACH VENDOR MUST BE IN THE INSPECTION FOLDER. IF NOT, CALL QE		A2							2	0	MS1
B	VISUAL											
1	PARTS MUST BE OF GOOD WORKMANSHIP		E 201				9		.65			VISUAL
2	PARTS MUST BE CAPABLE OF PASSING OVER .250 DIA MANDREL WITHOUT SPLITTING PER NOTE 3		E 101				9		.40			.250 PIN MICROSCOPE
3	PARTS MUST BE FREE OF DAMAGE		C				9		1.0			VISUAL
220												
C	CERTIFICATION											
1	BC CERTIFICATION PER NOTE 2 (MATERIAL)		A2							PILOT LOT		VISUAL
2	BC CERTIFICATION PER NOTE 4 (VIRGIN MATERIAL)		A2							PILOT LOT		VISUAL

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
EYELET, DIAPHRAGM	EXT. TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9298599			ORIG	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	**DIE/MOLD CHECK** AN ACCEPTABLE DIE/MOLD CHECK FOR EACH DIE OR MOLD CAVITY TO THE LATEST PRINT REVISION FOR EACH VENDOR MUST BE IN THE INSPECTION FOLDER. IF NOT, CALL QE		A2							E	O	MS1
B	CERTIFICATION											
1	BC CERT FOR NOTE 2 (MATERIAL)		A2							PILOT LOT		VISUAL
C	VISUAL											
1	PARTS MUST BE OF GOOD WORKMANSHIP AND TO BE FREE OF DAMAGE		C				9		1.0			VISUAL
D	DIMENSIONAL											
1	.142 -.004 DIA.		B2				9		1.0			GH 3360
2	.120 MIN DIA											STD PIN GAGE
3	.080 -.005											1" MICR.
4	.008 R MAX											VISUAL
5	⌖ | A | .005 OF .210 DIA											H28010136-61

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
TERMINAL, BREAKWIRE	EXT. TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9298601			ORIG	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	**DIE/MOLD CHECK** AN ACCEPTABLE DIE/MOLD CHECK FOR EACH DIE OR MOLD CAVITY TO THE LATEST PRINT REVISION FOR EACH VENDOR MUST BE IN THE INSPECTION FOLDER. IF NOT, CALL QE		A2							2	0	M91
B	CERTIFICATION											
1	BC CERT. PER NOTE 3.		B2							PILOT LOT		DESTRUCTIVE TEST AND MEASURE THICKNESS - GAGE
C	VISUAL											
1	PROTECTIVE FINISH PER NOTE 3		B2				9		1.0			VISUAL
2	PARTS TO BE PROPERLY IDENTIFIED AS -1 OR -2		B2				9		1.0			VISUAL

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INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
URETHANE COMPOUND	EXT. TRIP LINE	2		17 AUG 78
PART NUMBER	**PART FAMILY**	**OPERATION NUMBER**	**REV/MOD**	**TALLY NUMBER**
9298617				
QEID	**INSPECTION DEPARTMENT**	**APPROVALS**		**SHEET**
M33				1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	CERTIFICATION											
1	BC CERTIFICATION REQUIRED PER NOTE 1		A2							PILOT LOT		VISUAL
B	VISUAL											
1	VERIFY THAT PART NUMBER IS CORRECT		A2							EA LOT		VISUAL

INSPECTION PROCEDURE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
GASKET, FIBROUS	EXT. TRIP LINE	2		7 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9298618			ORIG	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	**DIE/MOLD CHECK** AN ACCEPTABLE DIE/MOLD CHECK FOR EACH DIE OR MOLD CAVITY TO THE LATEST PRINT REVISION FOR EACH VENDOR MUST BE IN THE INSPECTION FOLDER. IF NOT, CALL		A2							3	0	MS1
B	DIMENSIONAL											
1	.365 - .010		B2				9		1.0			COMPARATOR + CHART
2	.158 +.004 DIA.		B2				9		1.0			" "

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INSPEC[illegible]ONE

PART NAME	PROGRAM	IP ISSUE	SAMPLING PLAN REVISION	DATE
PAPER, GASKET	EXT. TRIP LINE	2		9 AUG 78

PART NUMBER	PART FAMILY	OPERATION NUMBER	REV/MOD	TALLY NUMBER
9298619			ORIG	

QEID	INSPECTION DEPARTMENT	APPROVALS	SHEET
M33			1 OF 1

ITEM	CHARACTERISTICS	RE	CD	SW	SK	CR	SP	L	AQL	N	C	EQUIPMENT
A	CERTIFICATION											
1	BC CERT REQUIRED PER NOTE 4 (REQUIREMENTS)		A2							PILOT LOT		VISUAL
B	VISUAL											
1	VERIFY THAT PART NUMBER IS CORRECT		A2							EA LOT		VISUAL
2	PARTS MUST BE OF GOOD WORKMANSHIP AND MUST BE FREE OF DAMAGE.		C				9		1.0			VISUAL

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APPENDIX D
COST DATA

APPENDIX D
COST DATA

Cost data has been developed for the following contract requirements:

- Unit Product Cost (UPC) for the baseline design
- UPC for production engineered design
- Production facility costs for a 200,000 units per month production line rate.

Cost summaries on the following pages provide detail on costs as follows:

UPC Baseline	$4.514 each
UPC PEP Version	$3.033 each

The UPC costs include the cost of the Release Mechanism as provided by the ADAM line. The $1.568 each price for the Release Mechanism is a figure from 1977 production. The current 1978 price shows a reduction in this figure which would further reduce the $3.033 price. Additional savings will also be realized when the leadwire soldering is automated and when anticipated Release Mechanism reductions are accomplished, the price per sensor should be approximately $2.25.

The UPC costs have not been developed to show a cost vs. quantity relationship. Information if presented however, which shows the line rates for various combinations of assembly machines. Cost information for line rates other than 200,000 units per month can be furnished upon request.

The production facility costs are also presented in detail in this appendix which includes separate cost information for debug and machine demonstration hardware.

XM74 GEMSS EXTENDED TRIPLINE SENSOR FINAL UPC

Type of Contract:	PEP Contract DAAK10-77-C-0047
Customer	ARRADCOM
Type of Proposal:	C
Procurement Manager:	All material estimates are same as preliminary UPC of July, 1977. H. Spillers reviewed MPR's in July, 1977 for parts unique to XM74. ADAM Sensor parts taken from ADAM Contract 0048.
Production Manager:	Ken Jenson
Quality/Delivery Period:	Quantity of 200,000/Month was stated in the contract. It is assumed that this would be for one year. Since no delivery time was specified, the costs are given in 1977 dollars.

Groundrules/Assumptions:

1. This is a budgetary estimate.
2. Estimate is in 1977 dollars and is assumed to be the second year of production (i.e., 2,400,000 sensors) after an initial quantity of 165,000. Maximum rate is to be 200,000 per month.
3. The cost of the release mechanism assembly is taken from the current ADAM contract with adjustments for total quantity and assembly losses for assembly into sensors.
4. Cost of "D Test" units have been estimated on the basis of 4 lots of 50 units each per month. The cost for the "D Test" units are covered in the assembly scrap rate.

5. The UPC is based on 1:8:5 production.

6. It is assumed that the use of Government Furnished Equipment will be rent free.

7. All tooling and equipment necessary for quantity estimated has been designed, de-bugged and will be available. The non-recurring costs for the machines, tooling and facilities are not included in this estimate.

8. The item design is as described by the drawings and specifications transmitted to Honeywell from ARRADCOM and received 7 June 1977 and revised in accordance with producibility recommendations submitted by Honeywell to ARRADCOM 15 August 1978.

9. Machine usage (i.e., the production line) for this production is based on the following assumptions:

   a. Honeywell OML machines have been assumed for assembly operations. The specific machine requirements are listed on the attached table.

   b. One operation remains as a manual, semi-automatic operation, namely, the soldering of (2) leadwires to the sensor. More development work is required for full automation of leadwire soldering.

Unit Cost/Price:

	Basic Cost July, 1977	Basic Cost 30 August 1978
Quantity	2,400,000	
Material	0.644	0.643
Factory Labor & Burden	2.346	1.129

Eng. Labor & Burden	0.211	0.201
Tooling plus shrinkage/surplus	0.088	0.052
Factory Cost	3.279	2.025
G&A at 19.7%	0.646	0.399
Total Cost	3.925	2.424
Profit at 15.0%	0.589	0.364
Price	4.514	2.788

HONEYWELL COST SUMMARY

DESCRIPTION: XM74 EXTENDED RANGE TRIPLINE SENSOR ASSEMBLY - CONTRACT C-0047
ENDSETARY UPC IN 1977$ FINAL UPC FOR PEP
RATE 20,000/MONTH FOR ONE YEAR AFTER 1ST YEAR OF 125,000 UNITS SHEET 1 OF 7

CONTRACT	Est. of 7/25/77 (Initial)			Current Sensor Assy with Rel. Mech. from 7/25/77 (Final)			Alternate - Current Sensor Assy with Leadwire Assy Soldered on Main.			
BY: FNR DATE: 8/20/78 COST PER	Rel. Mech. from ADAM EA	Sensor Assy less Rel. Mech. EA	Total EA	Rel. Mech from ADAM EA	Sensor Assy less Rel. Mech. EA	Total EA	Rel. Mech Same as Prev. EA	Sensor Assy less Rel. Mech. EA	Total EA	
REFERENCE SHEET	234	34		234	6					
S.C. MATERIAL										
OTHER MATERIAL										
SUBTOTAL MATERIAL	0.425	0.189		0.425	0.188		0.425	0.188		
MAT'L ACC. @ 4.81 %	0.021	0.009		0.021	0.009		0.021	0.009		
TOTAL MATERIAL	0.446	0.198		0.446	0.197		0.446	0.197	0.643	
PRODUCTION LABOR	0.161	0.756		0.161	0.308		0.161	0.234	0.395	
PRODUCTION BURDEN	0.339	1.021		0.339	0.426		0.339	0.326	0.665	
INSPECTION LABOR	0.018	0.021		0.018	0.021		0.018	0.021	0.039	
INSPECTION BURDEN	0.014	0.016		0.014	0.016		0.014	0.016	0.030	
SUBTOTAL	0.978	2.012		0.978	0.967		0.978	0.794	1.772	
SHRINK/SURPLUS @ 0.9 %	0.008	0.016		0.008	0.008		0.008	0.006	0.014	
QUALITY ENGR. LABOR	0.014	0.009		0.014	0.009		0.014	0.009	0.023	
QUALITY ENGR. BURDEN	0.011	0.007		0.011	0.007		0.011	0.007	0.018	
PROD'N ENGR. LABOR	0.035	0.027		0.035	0.027		0.035	0.027	0.062	
PROD'N ENGR. BURDEN	0.026	0.020		0.026	0.020		0.026	0.020	0.046	
PROD'T ENGR. LABOR	0.024	0.004		0.024	0.004		0.024	0.004	0.028	
PROD'T ENGR. BURDEN	0.021	0.003		0.021	0.003		0.021	0.003	0.024	
TOOLING/GAGES 2%18M	0.022	0.042		0.022	0.019		0.022	0.016	0.038	
FACTORY COST	1.139	2.140	3.279	1.139	1.064	2.203	1.139	0.886	2.025	
Sell/Tech. @ %										
SUBTOTAL 19.7	0.224	0.422	0.646	0.224	0.210	0.434	0.224	0.175	0.399	
GEN. & ADM. @ %										
TOTAL COST	1.363	2.562	3.925	1.363	1.274	2.637	1.363	1.061	2.424	
PROFIT @ 15.0 %	0.205	0.384	0.589	0.205	0.191	0.396	0.205	0.159	0.364	
PRICE	1.568	2.946	4.514	1.568	1.465	3.033	1.568	1.220	2.788	
CAS414										
TOTAL PRICE										

Honeywell

COST ESTIMATE DETAIL

DESCRIPTION 2800960 RELEASE MECH ASSY FROM ADAM SHEET 2 OF 7
RFQ NO. OR CONTRACT NO. DAAA21-77-C-0048 DATE 3/28/77
QUANTITY 2,400,000 • 200,000 /MO. BID RATES 7/1/77 BY ENR

PRODUCTION LABOR AND BURDEN 1977 1M

DEPT.	STANDARD HOURS	EFF. %	SALV. %	SCRAP %	ADJUSTED HOURS	LABOR RATE	LABOR COST	BURDEN RATE	BURDEN COST
FROM QTY 2,000,000 AFTER 165,200									
MB109	Machine Hours 2.00	85	1	0	2.35	8.19	88.29	133%	117.43
MB702	3.52	80	1	12	5.90	9.53	51.46	343%	176.51
				TOTALS			139.75		293.94
	FROM CURVE 2,400,000 AFTER 165,200						137.00		288.-
	w/15% SCRAP INTO XM174 SPECIMEN						161.00		339.-
TOTAL									

MATERIAL

TYPE	STANDARD COST	ADJUSTED COST W/ 15 % SCRAP
FROM ADAM	367.59	
FROM CURVE	361.00	
w/RAW STOCK FOR XM174	0.425	
TOTAL		

INSPECTION AND Q.C. ENG LABOR AND BURDEN

TYPE	ESTIMATED 19____ MM/HR	LABOR RATE	LABOR	BURDEN RATE	BURDEN	ESTIMATED 19____ MM/HR	LABOR RATE	LABOR	BURDEN RATE	BURDEN	TOTAL LABOR	TOTAL BURDEN
REC. INSPECTION												
MFG. INSPECTION												
ASS'Y. INSPECTION												
TOTAL INSPECTION COST/												
Q.C. ENGR.-PROC.												
Q.C. ENGR.-MFG.												
Q.C. ENGR.-ASS'Y.												
TOTAL Q.C. ENG COST/												

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Honeywell

COST ESTIMATE DETAIL

DESCRIPTION ST. RANGE TURBINE SENSOR LESS ARM Rev. A SHEET 3 OF 7

RFQ NO. OR CONTRACT NO. DATE 7/20/77

QUANTITY 2,400,000 @ 200 M /MO. BID RATES / / BY ENR

PRODUCTION LABOR AND BURDEN 1977

DEPT.	STANDARD HOURS	EFF. %	SALV. %	SCRAP %	ADJUSTED HOURS	LABOR RATE	LABOR COST	BURDEN RATE	BURDEN COST
NB03	28.10	90	4	4	26.60	8.19	217.85	133%	289.74
NB502	0.51	80	8	12	0.78	9.53	7.43	343%	25.50
NB03	50.00	85	1	2	64.83	8.19	530.96	133%	706.18
							756.24		1,021.42
TOTAL									

MATERIAL /EA

TYPE	STANDARD COST	ADJUSTED COST W/ % SCRAP
PURCHASE		
	.14059	.19893
SUBTOTAL PURCH.		
SUBCONTRACT		
SUBTOTAL S.C.		
OTHER		
SUBTOTAL OTHER		
TOTAL		

INSPECTION AND Q.C. ENG LABOR AND BURDEN

TYPE	Total Including Rec. Insp. ESTIMATED 19 77 MM/HR	LABOR RATE	LABOR	BURDEN RATE	BURDEN	ESTIMATED 19 ____ MM/HR	LABOR RATE	LABOR	BURDEN RATE	BURDEN	TOTAL LABOR	TOTAL BURDEN
REC. INSPECTION	351	9.92		77%								
MFG. INSPECTION												
ASS'Y. INSPECTION	~~490.5~~ 441.5											
TOTAL INSPECTION COST/EA			7842.78 0.039		0.039							
Q.C. ENGR.-PROC.												
Q.C. ENGR.-MFG.												
Q.C. ENGR.-ASS'Y.	350	12.64	4424.-	77%								
CAL TECH.	16	10.50	168.-									
TOTAL Q.C. ENG COST/EA			4592 0.023		0.018							

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MC-20 REV 4/71

Honeywell

COST DETAIL

DESCRIPTION Extended Turbine Sensor Assy - Turbofan Eng. SHEET 4 OF 7

RFQ NO. OR CONTRACT NO. 1977 # DATE 7/20/77

QUANTITY 200 M/Mo & _____ /MO. BID RATES / / BY _____

ENGINEERING LABOR AND BURDEN

TYPE	I.T.D	ESTIMATED 19 77					ESTIMATED 19 ____					TOTAL	
	MM OR $	MM/HR	LABOR RATE	LABOR	BURDEN RATE	BURDEN	MM/HR	LABOR RATE	LABOR	BURDEN RATE	BURDEN	LABOR	BURDEN
PRODUCTION ENGR.		5.0	2469	12,340	74%								
TOTAL PRODUCTION ENG.				12,340									
COST EA				0.062		0.046							
PRODUCT ENG.													
DEVELOPMENT ENG. $		1.5 MM	2960	4440	86%								
PROD. ENG. SUPPORT ENG. $		30 HRS	1709	512	86%								
EVAL. ENGR.													
MISC. TECH. & DRAFT.													
EV. TECH. ST. ANAL.													
C&M TECH (2-RAT)		39 HRS	10.08	393									
MATERIAL HANDLING		30 HRS @ 5.63		169									
TOTAL PROD ENG.				5814									
COST /EA				0.029		0.024							

TOOLING ESTIMATE TYPE	LABOR RATE	BURDEN RATE	TOOLS HRS	TOOLS LABOR	TOOLS BURDEN	GAGES HRS	GAGES LABOR	GAGES BURDEN	AUTO-TOOLING HRS	AUTO-TOOLING LABOR	AUTO-TOOLING BURDEN
TOOL DESIGN											
TOOL MAKE											
MACHINE LAB											
MAINTENANCE											
SUBTOTAL LABOR & BURDEN											
PURCHASE TOOLING											
VENDOR TOOLING											
MATL. ACQ.											
TOTAL											
COST/											

SOURCING REPORT

Honeywell

SYSTEM ____________
DEVICE NUMBER 28112266-001
DEVICE NAME Ext. Range Tripline Sensor
BID QUANTITY ____________

SOURCE CODE:

A. COST	E. FACILITIES	I. UNDERLOAD
B. QUALITY	F. ENGRNG CONTROL	J. INTER DIVISION
C. DELIVERY	G. PROCESSING	K. OTHER - ADAM
D. TOOLING	H. OVERLOAD	

SHEET 5 OF 7
INITIAL FNR DATE 7/20/77
TOTAL STD COST LISTING DTD ____________

PART NUMBER	DASH NO.	REV	PART DESCRIPTION	USAGE PER DEVICE	UNIT COST	PAGE	MATERIAL PURCH. $/M	MATERIAL S.C. $/M	MATERIAL OTHER $/M	PAGE	MAKE HRS. S/U	MAKE HRS./M DEPT. NB 103	MAKE HRS./M DEPT. NB 502	SOURCING CODE
												Mach. Hours		
28112266	001	A	Ext. Range Tripline Sensor	1		–						6.0 –		
2270	001	–	Sensor Case + Bobbin Assy	1		–						2.0 .50		
2276	001	–	Bobbin Assy.	1		–						11.0		
2277	001	–	Weight	1		•		9.04						
2279	001	–	Bobbin	1		•		12.84						
9292984	001	–	Thread Alter. 28009015	[illegible]										
9293003	001	–	Tape											
28112280	001		Release Mech. + Case Assy	1		–						2.0 –		
81	001	A	Case	1		•		67.28						
82	001	A	Sleeve	1		•		9.56						
72	001		Ball, Locking	4	28105079			9.04						K
83	001		Washer, Case	1	28101102	•		8.00						
9292991	001		Release Mech.	1	See separ. Cost									K
9292979	001		Cap	1	28102829			3.99					0.39	K
28112274	001		Anchor	1		•		16.26						
9292978	001		Ball	1	28105078			4.52						K
28112275	001		Eyelet, Interface	1		•		2.06						
94	001		Boost. Spring	1		•		6.84						
9292977	001		Eject. "	1				2.42				0.1		K
73	001		Wire, Magn., Elect.	[illegible]				.21						K
75	001		Cover, Post	1				7.29						K
74	001		Ring, Retain., Bobbin	1				.34					0.12	K

TRACEABILITY INDEX:	PGS	THRU						
BILL OF MATERIALS			TOTAL THIS SHEET		160.59		221.50	0.51
MATERIALS QUOTE			ACCUMULATED TOTALS					
LABOR ESTIMATES								

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COST ESTIMATE DETAIL

DESCRIPTION Extended Range Tripline Sensor Less Rel. Mech. SHEET 6 OF 7

RFQ NO. OR CONTRACT NO. DATE 8/30/78

QUANTITY 2,400,000 @ 200,000 /MO. BID RATES / / BY FNR

PRODUCTION LABOR AND BURDEN 1977

	DEPT.	STANDARD HOURS	EFF. %	SALV. %	SCRAP %	ADJUSTED HOURS	LABOR RATE	LABOR COST	BURDEN RATE	BURDEN COST
Mach	NB105	15.83	90	4	4	19.06	8.19	156.10	133%	207.61
Hand	NB103	13.61	85	8	2	17.65	9.19	144.55	133%	192.25
	NB502	0.51	90	8	12	0.78	9.53	7.43	343%	25.50
								308.08		425.36
	ALTERNATE IF LEADWIRE SOLDERING IS INCLUDED IN MACHINE ASSEMBLY.									
Mach	NB105	15.83	90	4	4	19.06	8.19	156.10	133%	207.61
Hand	NB103	6.61	85	8	2	8.57	8.19	70.19	133%	93.35
	NB502	0.51	90	8	12	0.78	9.53	7.43	343%	25.50
								233.72		326.46
	TOTAL									

MATERIAL /EA

TYPE	STANDARD COST	ADJUSTED COST W/15 % SCRAP
PURCHASE		
	159.74	187.93
SUBTOTAL PURCH.		
SUBCONTRACT		
SUBTOTAL S.C.		
OTHER		
SUBTOTAL OTHER		
TOTAL		

INSPECTION AND Q.C. ENG LABOR AND BURDEN

TYPE	ESTIMATED 19____ MM/HR	LABOR RATE	LABOR	BURDEN RATE	BURDEN	ESTIMATED 19____ MM/HR	LABOR RATE	LABOR	BURDEN RATE	BURDEN	TOTAL LABOR	TOTAL BURDEN
REC. INSPECTION												
MFG. INSPECTION												
ASS'Y. INSPECTION												
TOTAL INSPECTION COST/												
Q.C. ENGR.-PROC.												
Q.C. ENGR.-MFG.												
Q.C. ENGR.-ASS'Y.												
TOTAL Q.C. ENG COST/												

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COST DATA BY PART/MAKE OR BUY SUMMARY

Honeywell

SYSTEM ______
DEVICE NUMBER ______
DEVICE NAME Tripline Sensor, Extended
BID QUANTITY ______

SOURCE CODE:

A. COST	E. FACILITIES	I. UNDERLOAD
B. QUALITY	F. ENGRNG CONTROL	J. INTER DIVISION
C. DELIVERY	G. PROCESSING	K. OTHER
D. TOOLING	H. OVERLOAD	

SHEET 7 OF 7
INITIAL FNR DATE 8/25/78
TOTAL STD COST LISTING DTD ______

PART NUMBER	DASH NO.	REV	PART DESCRIPTION	USAGE PER DEVICE	UNIT COST	PAGE	MATERIAL: PURCH. $/M	MATERIAL: Sensor S.C. $/M	MATERIAL: Rel. Mech. OTHER $/M	PAGE	MAKE: HRS. S/U NB502	MAKE: HRS./M DEPT. NB103 HAND	MAKE: HRS./M DEPT. NB103 MACH.	SOURCING
9292972			Sensor Assy	1				-				10.00	5.00	
9292976			Sensor Case/Bobbin	1				-				1.00	2.50	
9292976A			Case-Sleeve-Spr-Assy	1				-				--	2.50	
9292986			Rel. Mech.-Case Assy	1				-				1.00	2.50	
9292991 (3900 9660)			Rel. Mech. Assy	1	↑				-					
9298582 (3900 0061)			Spring Washer	1								-		
9298587 (3910 9134)			Housing Assy.	1					-					
9298589 (3910 9959)			Tube, Housing	1										
9298588 (3911 1103)			Cup, Housing	1										
9292997 (3910 9250)			Diaphragm Assy	1					-					
9298618 (3910 7608)			Gasket	1										
9298598 (3910 7898)			Diaphragm	1										
9298599 (3911 0136)			Eyelet	1	ADAM									
9298597 (3912 9586)			Plate, Diaphragm	1										
9298586 (3900 9940)			Ring, Lock	1										
9298601	-001 (3910 9285)		Term., RH	1										
	-002	"	, LH	1	↓									
9298581			Ball, Locking	4		•		9.04						
9292987			Case, Sensor	1		•		67.28						
9292988			Sleeve	1		•		9.52						
9292989			Washer, Case	1		•		8.00						
9292990			Spring, Booster	1		•		6.04						
9292981			Washer	1	E	•		1.00						
9298579			Spring, Elect.	1		•		2.42						
* 9292982			Bobbin Assy	1				-				1.61	3.33	
25009925-001 (9298592)			Thread, Polyester	.0064	F									
25108992-001			Body	1		•		12.84						
9292980			Anchor	1		•		16.26						
9298581			Ball, Locking	2		•		4.52						
9298579			Cap	1		•		3.99			0.39			
9299575			Post Cover	1		•		7.29						
9298577 or 74			Ring, Retain.	1		•		.84			0.12			
9298576			Wire, Electr. Magnet	1-5000		•		.49						
*			Bobbin Wgt.	1		•		9.44						
TRACEABILITY INDEX: BILL OF MATERIALS PGS ___ THRU ___			TOTAL THIS SHEET					159.74			0.51	13.61	15.83	
MATERIALS QUOTE ___ ___ LABOR ESTIMATES ___ ___			ACCUMULATED TOTALS											

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9/1/78
FNR

XM74 Extended Tripline Sensor PEP Program

Budgetary IPF in 1979 & 1980 Dollars (25 Yrs @ 8% in 1980)

Total Machines for 200,000/Mo.

		Qty.	Factory Cost	G&A @ 15.1%	Total Cost	Fee @ 10%	Price
Machines: Build of Qty Shown							
#7	Bobbin & Weight Assy.	4	839,689				
8	Diaphragm Assembly	1	140,103				
9	Housing Assembly	1	123,489				
10	Sensor Release Mech.	2	338,445				
10A	Terminal Assembly	2	88,760				
11	Sensor Case & Sleeve Assy.	2	364,189				
12	Sensor Case & Bobbin Assy.	2	397,892				
12A	Spring Winders	4	137,910				
12B	Sensor Case & Spring Assy.	2	330,638				
13	Sensor & Breakwire Assy.	2	309,811				
13A	Epoxy Dispens. Fixture	2	80,870				
	Magazines		98,412				
	Grand Total Machines & Magazines		3,250,267	446,789	3,741,046	374,105	4,115,151
Build Support							
	Quality Engr	520 Hrs @ 26.48 = 13,770					
	Reliabil. Engr	393 Hrs @ 40.51 = 15,920					
	Design Engr	347 Hrs @ 40.51 = 14,057					
	Prod'n Engr	6412 Hrs @ 30.32 = 194,412					
	Inspection	375 Hrs @ 19.66 = 7,373					
	Total Build Support		245,532	37,075	282,607	28,261	310,868
Demonstration Tests							
	Quality Engr	4028 Hrs @ 26.48 = 106,661					
	Reliabil. Engr	2126 Hrs @ 40.51 = 86,124					
	Design Engr	692 Hrs @ 40.51 = 28,033					
	Prod'n. Engr	1000 Hrs @ 30.32 = 30,320					
	Inspection	750 Hrs @ 19.66 = 14,745					
	Total Demonstration Tests		265,883	40,148	306,031	30,603	336,634
Other Costs							
	Area Prod: Plant Engr. Staffing @ 30.32 =	15,766					
	Maint. 1948 Hrs @ 29.86 =	35,025					
	Matl. @ $24,000 w/44% =	32,260					
	Lot Accept. & Test Equip. for Imp. Test. =	62,640					
	Lot Accept. & Test Equip for Func. Test =	16,704					
	Total Other Costs		162,395	24,522	186,917	18,692	205,609
De-Bug. & Acceptance Hardware			347,249	52,435	399,684	39,968	439,652
	Grand Totals		4,221,316	644,969	4,916,285	491,629	5,407,914

MACHINE COST ESTIMATES

DATE 8/30/78 BY ENR

CUSTOMER ARRADCOM

BID RATES 8/7/78 (ISSUE)

DEVICE/PROJECT XM74 Extended Turbine Sensor PEP ☐ BUDGETARY ☐ FIRM ☐ GOVERNMENT ☐ COMMERCIAL

DEPARTMENT	LABOR RATE 2/5/79 8/2/78 HR	Bobbin + Wet. Assy. #7		Diaphragm Assembly #8		Housing Assembly #9		Sensor Release Mech. #10	
		HRS	DOLLARS	HRS	DOLLARS	HRS	DOLLARS	HRS	DOLLARS
MATERIAL			53,007		33,894		36,236		46,882
ACQ 4.4 %			2,332		1,491		1,594		2,063
TOOL ROOM L	14.77	3609	53,305	2234	32,996	1,806	26,675	2,827	41,755
B 65 %			34,648		21,447		17,339		27,141
TOOL DESIGN L	15.63	153	2,391	45	703	50	782	77	1,204
B 30 %			717		211		235		361
MACH LAB L	15.97	1,728	27,423	1,002	15,902	796	12,633	1229	19,504
B 138 %			37,894		21,945		17,434		26,916
MAINT L	13.89	883	12,265	628	8,723	576	8,001	760	10,556
B 32 %			3925		2,791		2,560		3,378
L									
B %									
FACTORY COST			227,859		140,103		123,489		179,760
TOTAL COST W/ % G&A									
PRICE W/ % PROFIT									
NO. ADD'L MACH		3@	203,944		—		—	1@	158,735
SHIP COST									
TOTAL			839,689		140,103		123,489		338,495

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SHEET 2 OF 11

MACHINE COST ESTIMATES

DATE 8/30/78 BY FNR

CUSTOMER ARRADCOM

BID RATES 8/7/78 (ISSUE)

DEVICE/PROJECT XM774 EXTENDED TRIPLINE SENSOR P.E.P. ☐ BUDGETARY ☐ FIRM ☐ GOVERNMENT ☐ COMMERCIAL

DEPARTMENT	LABOR RATE HR	TERMINAL ASSEMBLY #10A		SENSOR CASE & SUBSYS ASSY #11		SENSOR CASE & BASE ASSY #12		SPRING WINDERS (A) #12A	
		HRS	DOLLARS	HRS	DOLLARS	HRS	DOLLARS	HRS	DOLLARS
MATERIAL			8,913		38,630		36,403		34,761
ACQ 4.4 %			392		1,700		1,602		1,529
TOOL ROOM L	14.77	558	8,242	4,002	59,110	4,332	63,984	839	12,392
B 65 %			5,357		38,422		41,590		8,055
TOOL DESIGN L	15.63	50	782	105	1,641	164	2,563	121	1,891
B 30 %			235		492		769		567
MACH LAB L	15.87	398	6,316	983	15,600	1,236	19,615	189	2,999
B 139 %			8,716		21,528		27,069		4,139
MAINT L	13.89	343	4,764	811	11,265	785	10,904	143	1,986
B 32 %			1,524		3,605		3489		636
L									
B %									
FACTORY COST			45,241		191,993		207,988		68,955
TOTAL COST W/ % G&A									
PRICE W/ % PROFIT									
NO. ADD'L MACH		1 @	43,519	1 @	172,195	1 @	189,904	1 @	68,955
SHIP COST									
TOTAL			88,760		364,188		397,892		137,910

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SHEET 8 OF 11

MACHINE COST ESTIMATES

DATE 8/30/78 BY ENR

CUSTOMER ARRADCOM

BID RATES 8/7/78 (_____ ISSUE)

DEVICE/PROJECT XM 74 EXTENDED TRIPLINE SENSOR P.E.P. ☐ BUDGETARY ☐ FIRM ☐ GOVERNMENT ☐ COMMERCIAL

DEPARTMENT	LABOR RATE 1st-1979 2nd-1980 HR	SENSOR CASE + SPRING ASSY. #12B HRS	#12B DOLLARS	SENSOR + BREAKWIRE ASSY. #13 HRS	#13 DOLLARS	EPOXY DISPENSING FIXTURE #13A HRS	#13A DOLLARS	MAGAZINES HRS	MAGAZINES DOLLARS
MATERIAL			34,431		34,988		7,652		43527
ACQ 4.4 %			1,515		1,539		337		1,915
TOOL ROOM L	14.77	3,236	47,796	2,778	41,031	548	8,094	–	
B 65 %			31,067		26,670		5,261		
TOOL DESIGN L	15.63	158	2,470	71	1,110	48	750	96	1,500
B 30 %			741		333		225		450
MACH LAB L	15.87	1,155	18,330	1,155	18,330	322	5,110	48	762
B 138 %			25,295		25,295		7,052		1,052
MAINT L	13.89	725	10,070	753	10,459	360	5,000	–	–
B 32 %			3,222		3,347		1,600		–
L									
B %									
FACTORY COST			174,937		163,102		41,081		49,206
TOTAL COST W/ % G&A									
PRICE W/ % PROFIT									
NO. ADD'L MACH		1 @	155,701	1 @	146,709	1 @	39,789	1 @	49,206
SHIP COST									
TOTAL			330,638		309,811		80,870		98,412

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FILE NO. _____

HONEYWELL COST SUMMARY

DESCRIPTION XM74 EXTENDED TRIPLINE SENSOR DE-BUG HARDWARE FOR IPE MACHINES

SHEET _____ OF _____

											EXPLANATION
CONTRACT											
BY: FNR											
DATE: 9/30/78											
COST PER											
PURCH. MATERIAL											
S.C. MATERIAL											
OTHER MATERIAL											
SUBTOTAL MATERIAL	246,794										
MAT'L ACQ. ● 4.4 %	10,869										
TOTAL MATERIAL	257,653										
PRODUCTION LABOR	33,292										
PRODUCTION BURDEN	56,364										
INSPECTION LABOR											
INSPECTION BURDEN											
SUBTOTAL											
SHRINK/SURPLUS ● %											
QUALITY ENGR. LABOR											
QUALITY ENGR. BURDEN											
PROD'N ENGR. LABOR											
PROD'N ENGR. BURDEN											
PROD'T ENGR. LABOR											
PROD'T ENGR. BURDEN											
TOOLING/GAGES											
FACTORY COST	347,249										
GEN. & ADM. ● %											
TOTAL COST											
PROFIT ● %											
TOTAL PRICE											

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SHEET 8 OF 11

Honeywell

COST ESTIMATE DETAIL

DESCRIPTION XM74 Ext. Tripline Sensor DEBUG HOUSE SHEET ___ OF ___

RFQ NO. OR CONTRACT NO. ___ DATE 8/30/78

QUANTITY ___ • ___ /MO. BID RATES 1 1 BY ENR

	TOTAL	PRODUCTION LABOR AND BURDEN								MATERIAL		
DEPT.	STANDARD HOURS	EFF. %	SALV. %	SCRAP %	ADJUSTED HOURS	LABOR RATE	LABOR COST	BURDEN RATE	BURDEN COST	TYPE	STANDARD COST	ADJUSTED COST W/ % SCRAP
4302	15.20	96	4	6	12.54	11.39	199.94	383%	763.86	PURCHASE		
4304	495.0	91	4	6	601.83	11.39	6854.84		26,254.04			
										SUBTOTAL PURCH.		
4306	31.0	100	4	6	34.30	11.39	390.68		1,496.30	SUBCONTRACT		
4515	2,231.0	93	6	7.8	2,757.98	9.35	25,787.11	108%	27,850.08			
										SUBTOTAL S.C.		
										OTHER		
										SUBTOTAL OTHER		
TOTAL							33232.07		54,364.28	TOTAL		

INSPECTION AND Q.C. ENG LABOR AND BURDEN

TYPE	ESTIMATED 19___					ESTIMATED 19___					TOTAL	
	MM/HR	LABOR RATE	LABOR	BURDEN RATE	BURDEN	MM/HR	LABOR RATE	LABOR	BURDEN RATE	BURDEN	LABOR	BURDEN
REC. INSPECTION												
MFG. INSPECTION												
ASS'Y. INSPECTION												
TOTAL INSPECTION COST/												
Q.C. ENGR.-PROC.												
Q.C. ENGR.-MFG.												
Q.C. ENGR.-ASS'Y.												
TOTAL Q.C. ENG COST/												

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SHEET 9 OF 11

Sheet 1 of 2

COST ESTIMATE RECAP

PAGE ____ OF ____ DATE 5/18/78

DEVICE NO. EXTENDED RANGE TRIPLANE SENSOR
CPE NO. ____
PROD. ENG. ____

DESCRIPTION DE-BUG HARDWARE

E • McEsmal of 8-19-76 QTY 15,500

MATERIAL SOURCE
1. Purchased
2. Subcontract

a. Estimate
b. Quote
c. History

INFORMATION FROM PRODUCTION ENGINEERING / INFORMATION FOR COST ESTIMATING & PRICING

Part No.	Part Name	QTY	Hrs. per M MFG	Hrs. per M ASSY	$ per M MAT'L	Source	Mfg. Labor-Extendes Est.	Assy Labor /M 4502	Assy Labor /M 42??	Assy Labor /M 4320	Assy Labor /M 4515	Act.	Material /M
Mach. #7	Bobbin Winder	9292982									6.0		
—	9292955 Bobbin											E	[illegible].34
—	9292?-3 Wet											E	6.17
28009915	9298592 Thread		44/m @ 12.34#										4.90
	9298591 Tape		6?/m @ .045/yd.										.39
	Totals										5.0		[illegible]
	x 40M		x4			✓							[illegible]
Mach. #8	Diaphragm Assy.										6.00		
2911013?	9298577 Eyelet												3.40
291?7?0?	92985?9 Gasket												—
2917919	9298519 Diaphragm								1.80				22.08
29109296	9298597 Plate												11.66
	Totals								1.80		6.00		[illegible]
	x 15M					✓			27.00				226.20
Mach #9	Housing Assy.										0.90		
29109958	9298587 Tube, Housing												105.75
29112290	9299598 Cup												40.16
	Totals										0.90		152.15
	x 20M					✓							3092.5
Mach #10	Release Mech. Assy.										1.30		
29129??0	9298556 Lock Ring												33.56
29015?61	8592 Spr. Wire, x2									.07			20.36
29109194	8597 Hous. Assy.										0.70		[illegible]
29112292	2993 Bearing Assy.								1.80		1.00		[illegible]
	Totals								1.80	.07	4.90		[illegible]
	x 20M		x2			✓			36.0	1.4	98.00		5112.-
Mach #11A	Term. Shell Assy.										6.80		
	Reusable Term.								1.80	.07	3.00		255.45
29109285	9298681-1 Term.	2											8.11
	-2 Term.	2											8.11
	Totals								1.80	.07	3.00		272.17
	x 10M		x2						18.0	0.70	30.0		2721.70
	Totals Sheet 1							—	82.0	2.10	64.0		12,4[illegible]
	Sheet 2							2.60	179.?	13.40	1013.60		99,3[illegible]5
	Sheets 1 & 2							2.60	261.0	15.50	1077.60		111,854.05

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SHEET 2 OF 2

SHEET 11 OF 11

COST ESTIMATE RECAP

PAGE ____ OF ____ DATE [illegible]

DEVICE NO. EXTENDED RANGE TRIPLINE SENSOR
CPE NO.
PROD. ENG.

DESCRIPTION DE-SIGN HARDWARE
A-ADAM - 5/1/78
E2[illegible] ESCAL. ON 8-18-76 QTY 15,000

MATERIAL SOURCE: 1. Purchased 2. Subcontract — a. Estimate b. Quote c. History

INFORMATION FROM PRODUCTION ENGINEERING						INFORMATION FOR COST ESTIMATING & PRICING					
			Hrs. per M		$ per M	Mfg. Labor Extended	Assy Labor /M				Material
Part No.	Part Name	QTY	MFG	ASSY	MAT'L	Est.	4302	4304	4306	4515	Act. / Material
Mach. #11	Rel. Mech. & Case Assy. 9292980									1.2	
29112285	9292991 Rel. Mech. Assy.							1.80	.07	4.3	262.17
28105078	2981 Ball, Lock, #4				1.98						A 7.92
	2987 Case, Sensor										E 175.56
	2993 Sleeve										E 2.53
	2989 Wshr. Case										E 22.19
	Totals							1.80	.07	4.3	698.24
	x 20M		x 20					36.0	1.4	86.0	13,9[illegible].80
Mach. #12B	Sensor Case & Spring Assy.									1.2	
28112281	9292986 Rel. Mech. & Case Assy.							1.80	.07	5.5	699.24
28009598	8578 Elec. Spring									0.41	A 2.15
	2990 Boot-Spring										E 11.69
	2981 Eyelet										E [illegible]
	Totals							1.80	.07	5.97	745.13
	x 20M		x 20					36.0	1.4	119.40	14,702.60
Mach. #12	Sensor Case & Bobbin Assy.									1.2	
	Sens. Case & Spg. Assy.							1.80	.07	7.17	745.13
28109569	9298519 Cap			2.58/M	.83/#		0.12		0.06		A .83
5078	2981 Lock Ball #2				1.98						A 3.96
	2982 Bobbin Assy.									5.00	149.60
	2980 Anchor										E 185.92
	Totals						0.12	1.80	0.13	13.17	1,08[illegible].94
	x 20M		x 20				2.40	36.0	2.60	2[illegible].40	21,6[illegible].80
Mach. #12A	Bobbin Spring Winder									0.47	
	Wire - Roll			2.15/M	1.0/#						A 2.15
Mach. #13	Sensor & Breakwire Assy.									1.5	
	9292172 Sen. Case & Bobbin Assy.						0.12	1.80	0.13	13.31	1,084.84
28109469	9298576 Wire, Min. Breakwire			.025/M	1.98/#						A .05
9197	8577 Ring, Retain.			.035/M	2.50/#		0.01		0.07		A .34
8521	8575 Cover, Post										A 9.57
	Totals						0.13	1.80	0.20	13.37	1,09[illegible]
	x 20M		x 20				2.60	36.0	4.00	267.40	21,892.00
Mach. #13A	Epoxy Dispens.										
28112266	9292972 Tri Sensor, Ext. Range						0.13	1.80	0.20	14.87	1,094.60
MCR22501	Epoxy			12cc/M	.04784/cc						A .21
-02	Epoxy			24cc/M	.04784/cc						A .43
	Totals						0.13	1.80	0.20	14.87	1,095.24
	x 20M		x 2				2.60	36.0	4.00	297.40	21,[illegible]

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